

# EMC Fibre Channel and iSCSI with QLogic Host Bus Adapters in the Windows Environment

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## Contents

<b>Preface .....</b>	11
<b>Chapter 1      Installation and Configuration</b>	
How this guide works.....	16
Downloading latest QLogic drivers/firmware/BIOS files .	16
Installing the HBA .....	18
Special installation sequence for Stratus ftServers and EMC CLARiiON arrays .....	19
Matching the HBA with the correct PCI slot .....	19
Booting from the external storage array .....	24
Create a floppy disk with the EMC-approved driver and BIOS .....	24
Install/upgrade firmware and boot BIOS from DOS.....	25
QLogic Fibre Channel HBA BIOS/boot LUN settings .....	26
Verifying array/LUN visibility for boot .....	49
Installing a RAMDISK under the EFI shell .....	49
Installing the Windows operating system.....	51
Windows 2000/2003 external boot disk installation .....	51
Windows 2008 internal/external boot disk installation .....	59
Installing HBA driver and software utilities .....	69
Pre-installation guidelines.....	69
Driver installation/upgrade .....	70
Post-installation procedures.....	76
Show SAN.....	80
Verifying connectivity to the storage array .....	81
Verifying connectivity through QLogic SANSurfer .....	81
Verifying connectivity using the Server Manager .....	83
Installing additional Navisphere Host Agent software .....	86

## Chapter 2    Miscellaneous Planning and Procedures

Zoning and connection planning in a fabric environment.....	90
Installing and configuring the QLogic QLA4010 iSCSI	
HBA (TOE).....	91
Using the QLogic iSCSI SANsurfer application to	
configure iSCSI devices .....	91
Configuring iSNS settings for QLA4010.....	93
Booting from SAN with QLogic QLA40xx and	
Microsoft Initiator .....	99
Boot-from-SAN configuration restrictions.....	109
Benefits of booting from the storage array .....	109
Setting up external boot for IBM BladeCenter server	
HS40 (8839) .....	110
Configuring an HS40 BladeCenter server to boot	
from an external array .....	110
Blade server restrictions .....	111
Manually installing the HBA driver – Advanced users.....	112
Driver revision .....	112
Where to find the driver .....	113
Windows 2003 STORPort updates.....	114
Migrating Windows 2003 drivers from SCSI to STOR.....	114
Manual driver installation procedure for Windows 2000,	
2003, or Windows 2008 hosts.....	115
Updating the HBA driver in a Windows 2000, 2003, or	
Windows 2008 hosts.....	117
Upgrading to Windows 2003 from Windows 2000 .....	119
Editing the Windows time-out value .....	120
QLogic advanced utilities.....	121
Updating QLogic firmware/BIOS and applying NVRAM	
settings .....	121
Updating the flash BIOS using SANsurfer FC HBA	
Manager .....	122
Procedure for replacing a QLogic HBA in Stratus ftServers	
without rebooting .....	125
EMC CLARiiON storage arrays .....	125
EMC Symmetrix arrays with device masking enabled.....	126
Special instructions for the EMC CLARiiON CX200 series.....	128
Set the HBA FC-AL loop ID .....	128
Direct-connect dual-host clustering configurations .....	130

**Chapter 3 Troubleshooting**

Operating system/driver capabilities and limitations .....	134
LUNs.....	134
Volume sizes .....	134
Extended error logging by QLogic drivers.....	136
Understanding persistent binding.....	137
Known issues .....	140
Problems and solutions .....	141
Problem 1.....	141
Problem 2.....	141
Problem 3.....	141
Problem 4.....	142
Problem 5.....	142
Problem 6.....	142
Problem 7.....	143
Problem 8.....	143
Problem 9 .....	143
Event codes from the QLogic STORPort driver.....	144

**Appendix A Third-Party Software**

QLogic SANsurfer SANblade Manager .....	146
SANsurfer version history .....	146



## Figures

	<b>Title</b>	<b>Page</b>
1	Installation and configuration overview .....	17
2	PCI slot types and voltage key locations .....	20
3	HBA edge connectors .....	21
4	PCI Express slots .....	22
5	PCI Express slots aligned .....	22
6	QLogic banner .....	27
7	Main Fast!UTIL options window .....	28
8	Configuration Settings window .....	28
9	Adapter Settings window .....	29
10	Configuration Settings window .....	29
11	Selectable Boot Settings window .....	30
12	Select Fibre Channel Device window .....	31
13	Example of LUN 17 allocated to HBA .....	32
14	Selectable Boot Settings window .....	33
15	Warning dialog .....	33
16	Fast!UTIL Options window .....	34
17	Typical QLogic BIOS banner screen .....	34
18	Firmware boot manager menu .....	36
19	Device mapping table .....	37
20	Reference to QLogic Fibre Channel driver .....	38
21	QLogic directory .....	39
22	Fibre Channel Card Efi utility .....	40
23	QLogic efiutil all upgrade .....	41
24	Data loaded onto HBA(s) installed in server .....	42
25	QLogic HBA instances with specific firmware version .....	43
26	QLogic Fibre Channel drivers .....	43
27	Driver handle numbers .....	44
28	Fibre Channel driver configuration utility .....	45
29	Edit adapter settings .....	45
30	Connection option .....	46

31	Example array port WWN and LUN values .....	47
32	Options set .....	48
33	Example blkD as array port .....	48
34	Windows Setup screen with F6 prompt .....	53
35	Specifying a driver for your HBA .....	54
36	HBA selection screen .....	55
37	Windows setup screen .....	56
38	Existing partitions .....	57
39	Windows Boot Manager .....	60
40	Windows Setup screen .....	60
41	Windows Install screen .....	61
42	Windows operating system selection screen .....	61
43	Microsoft Software License Terms screen .....	62
44	Windows setup screen .....	63
45	Load driver screen .....	63
46	Loading driver screen .....	64
47	Browse for Folder screen .....	65
48	Specifying a driver for your HBA .....	66
49	Windows installation prompt screen .....	67
50	Install Windows screen .....	68
51	SANSurfer driver installation type .....	70
52	SANSurfer Driver Install Wizard for Windows welcome .....	71
53	SANSurfer driver selection .....	72
54	SANSurfer installation with version number .....	73
55	SANSurfer Java agent service message .....	74
56	SANSurfer driver installation completed successfully .....	75
57	SANSurfer driver installation complete .....	76
58	SANSurfer HBA install wizard .....	77
59	SANSurfer install wizard attach storage .....	78
60	SANSurfer HBA installation diagnostics results .....	79
61	Show SAN tree .....	80
62	SANSurfer icon .....	81
63	Connect to the host .....	82
64	SANSurfer, SANSurfer FC HBA manager .....	83
65	Server Manager window: Storage controllers pane .....	84
66	Server Manager window: Disk drives pane .....	85
67	SANSurfer iSCSI HBA Manager, connect to host .....	92
68	SANSurfer iSCSI HBA Manager, HBA Options .....	93
69	SANSurfer iSCSI HBA Manager, HBA Options, Firmware tab .....	94
70	Download Firmware dialog box .....	95
71	SANSurfer iSCSI HBA Manager, HBA Options, BIOS tab .....	95
72	SANSurfer iSCSI HBA Manager, Target Settings tab .....	96

73	SANsurfer iSCSI HBA Manager, Target Settings, IP Address dialog .....	96
74	Authentication Configuration, CHAP tab .....	97
75	SANsurfer iSCSI HBA Manager, Information tab .....	98
76	Utilities tabbed page .....	123
77	Reconfigure the HBA jumper .....	131
78	Original configuration before the reboot .....	139
79	Host after the reboot .....	139



## Tables

	<b>Title</b>	<b>Page</b>
1	EMC-supported QLogic HBAs .....	23
2	Pre-configured parameters .....	35
3	Blade servers/QLogic software support matrix .....	111



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*As part of an effort to improve and enhance the performance and capabilities of its product line, EMC from time to time releases revisions of its hardware and software. Therefore, some functions described in this document may not be supported by all revisions of the software or hardware currently in use. For the most up-to-date information on product features, refer to your product release notes.*

**Audience** This guide is intended for customers who need to install an EMC-approved QLogic host bus adapter into a Windows host environment or to configure the Windows host for connection to an EMC storage array over Fibre Channel.

**Related documentation** Related documents include:

- ◆ *EMC Host Connectivity Guide for Windows*
- ◆ *EMC Navisphere Manager 5.X Administrator's Guide*
- ◆ *EMC Navisphere Manager 6.X Administrator's Guide*
- ◆ *EMC ControlCenter Navisphere Host Agent and CLI for Windows 2000 and NT Version 6.X Installation Guide*
- ◆ *Storage-System Host Utilities for Windows 2000 and NT Administrator's Guide*
- ◆ *PowerPath for Windows Installation And Administration Guide*



### **IMPORTANT**

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Always consult the [EMC Support Matrix](#), available through E-Lab Interoperability Navigator at: <http://elabnavigator.EMC.com>, under the **PDFs and Guides** tab, for the most up-to-date information.

## Conventions used in this guide

EMC uses the following conventions for notes, cautions, and warnings.

**Note:** A note presents information that is important, but not hazard-related.



### **IMPORTANT**

**An important notice contains information essential to operation of the software.**



### **CAUTION**

**A caution contains information essential to avoid data loss or damage to the system or equipment. The caution may apply to hardware or software.**

## Typographical conventions

EMC uses the following type style conventions in this document:

### Normal

Used in running (nonprocedural) text for:

- Names of interface elements (such as names of windows, dialog boxes, buttons, fields, and menus)
- Names of resources, attributes, pools, Boolean expressions, buttons, DQL statements, keywords, clauses, environment variables, filenames, functions, utilities
- URLs, pathnames, filenames, directory names, computer names, links, groups, service keys, file systems, notifications

### Bold

Used in running (nonprocedural) text for:

- Names of commands, daemons, options, programs, processes, services, applications, utilities, kernels, notifications, system call, man pages

Used in procedures for:

- Names of interface elements (such as names of windows, dialog boxes, buttons, fields, and menus)
- What user specifically selects, clicks, presses, or types

### *Italic*

Used in all text (including procedures) for:

- Full titles of publications referenced in text
- Emphasis (for example a new term)
- Variables

### Courier

Used for:

- System output, such as an error message or script
- URLs, complete paths, filenames, prompts, and syntax when shown outside of running text

<b>Courier bold</b>	Used for: <ul style="list-style-type: none"><li>• Specific user input (such as commands)</li></ul>
<i>Courier italic</i>	Used in procedures for: <ul style="list-style-type: none"><li>• Variables on command line</li><li>• User input variables</li></ul>
< >	Angle brackets enclose parameter or variable values supplied by the user
[ ]	Square brackets enclose optional values
	Vertical bar indicates alternate selections - the bar means "or"
{ }	Braces indicate content that you must specify (that is, x or y or z)
...	Ellipses indicate nonessential information omitted from the example

## Where to get help

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**Product information** — For documentation, release notes, software updates, or for information about EMC products, licensing, and service, go to the EMC Powerlink website (registration required) at:

<http://Powerlink.EMC.com>

**Technical support** — For technical support, go to EMC Customer Service on Powerlink. To open a service request through Powerlink, you must have a valid support agreement. Please contact your EMC sales representative for details about obtaining a valid support agreement or to answer any questions about your account.

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# Installation and Configuration

---

This chapter describes the procedures for installing an EMC-approved QLogic host bus adapter (HBA) into a Microsoft Windows host environment and configuring the Windows host for connection to an EMC storage array over Fibre Channel.

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**Note:** Review the *EMC Support Matrix* for the latest information on approved HBAs and drivers.

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◆ How this guide works .....	16
◆ Installing the HBA .....	18
◆ Booting from the external storage array .....	24
◆ Installing the Windows operating system.....	51
◆ Installing HBA driver and software utilities.....	69
◆ Verifying connectivity to the storage array .....	81
◆ Installing additional Navisphere Host Agent software .....	86

## How this guide works

In an effort to simplify the installation and configuration of QLogic Fibre Channel HBAs, this guide follows a simple flow chart, as shown in [Figure 1 on page 17](#), that guides you through the necessary procedures to connect your Windows server to EMC storage arrays. Tips on planning, miscellaneous procedures, and troubleshooting information are located in [Chapter 2, "Miscellaneous Planning and Procedures,"](#) and [Chapter 3, "Troubleshooting."](#)

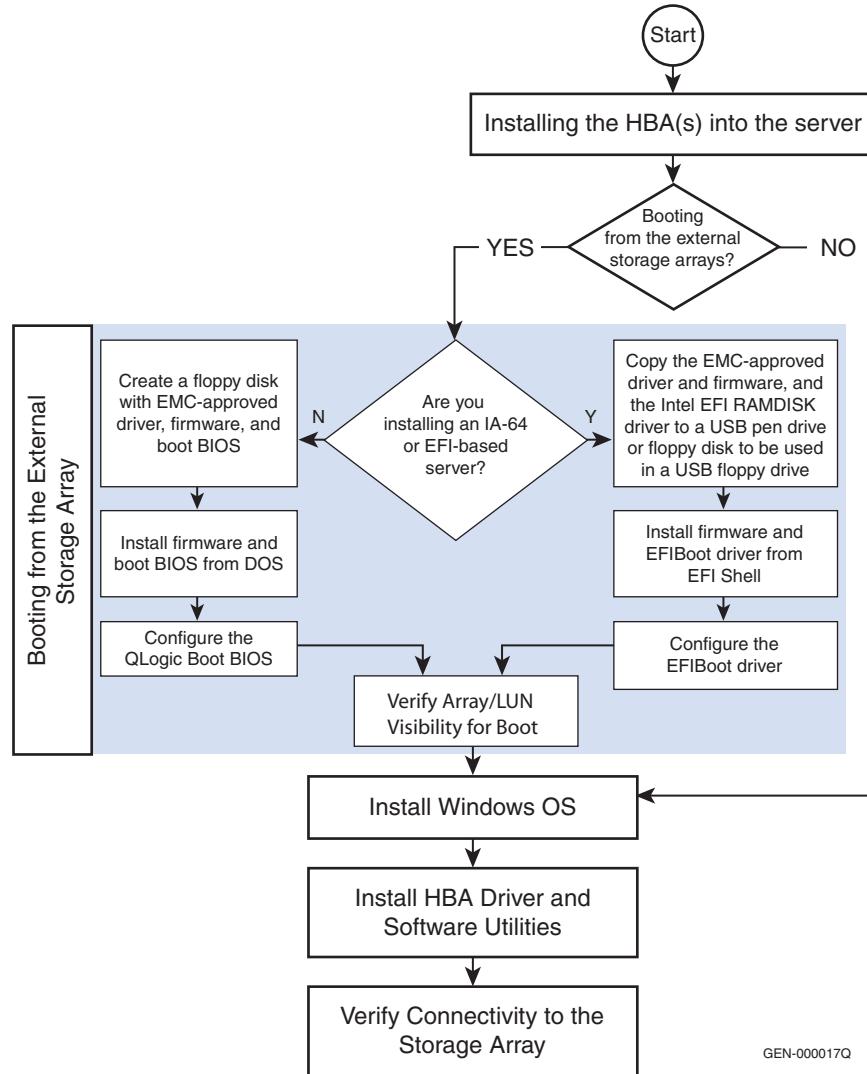
This document will guide you through the following steps:

1. ["Installing the HBA" on page 18](#)
2. ["Booting from the external storage array" on page 24:](#)
  - a. If *not* installing an IA-64 or EFI-based server:
    - ["Create a floppy disk with the EMC-approved driver and BIOS" on page 24.](#)
    - ["Install/upgrade firmware and boot BIOS from DOS" on page 25.](#)
    - ["QLogic Fibre Channel HBA BIOS/boot LUN settings" on page 26.](#)
    - ["Verifying array/LUN visibility for boot" on page 49.](#)
  - b. If installing an IA-64 or EFI-based server:
    - ["Installing a RAMDISK under the EFI shell" on page 49](#)
3. ["Installing the Windows operating system" on page 51.](#)
4. ["Installing HBA driver and software utilities" on page 69.](#)
5. ["Verifying connectivity to the storage array" on page 81.](#)

## Downloading latest QLogic drivers/firmware/BIOS files

Throughout this document, there are references to updated files from QLogic. All of the versions included on the QLogic CD packaged with your HBA are current as of this documents release. However, there may be updates to these files that may be necessary to download. For these, use the QLogic website, <http://www.qlogic.com>. From the main page on the QLogic website, click **Downloads** link on the left side of the page. On the resulting support page, click the **EMC** link under the OEM Models section. On the resulting page, click the **EMC Array** category for your

storage array. On the resulting EMC Approved Software page, it is possible to download the most recent EMC-approved drivers and BIOS files as well as documentation and helpful software tools.



**Figure 1** Installation and configuration overview

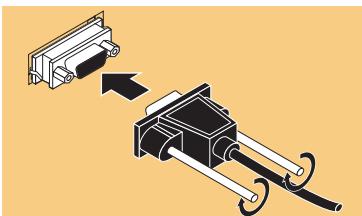
GEN-000017Q

## Installing the HBA

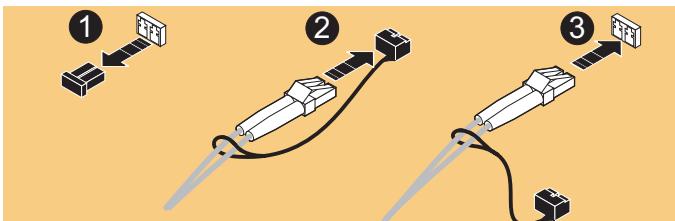
Follow the instructions included with your Host Bus Adapter (HBA). The HBA installs into a single slot.

To connect the cable to the HBA:

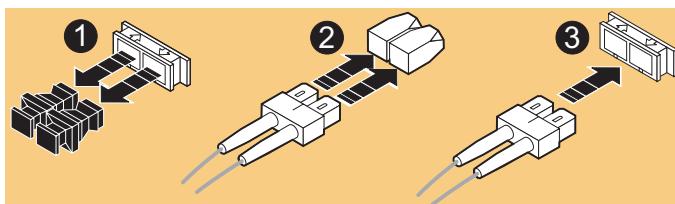
1. (Optical cable only) Remove the protective covers on each fiber-optic cable.
2. Plug one end of the cable into the connector on the HBA as shown in the appropriate figure. (The hardware might be rotated 90 degrees clockwise from the orientation shown.)
  - Copper Cable:



- LC Optical Cable:



- SC Optical Cable:



3. Plug the other end of the cable into a connector on the storage system or a hub/switch port.

4. Label each cable to identify the HBA and the storage/switch/hub port to which it connects.
5. After connecting all HBAs in the server, power up the server.

---

## Special installation sequence for Stratus ftServers and EMC CLARiiON arrays

A specific installation sequence is required when installing QLogic HBAs with the Stratus ft Servers and EMC® CLARiiON® storage. Failure to follow this sequence may result in a STOP: 0X0000007B bugcheck error when booting the Stratus server for the first time when connected to EMC CLARiiON storage.

With the Stratus ftServer, if the HBA detects EMC CLARiiON array targets but no accessible LUNs, it prevents the Stratus server from booting. In this configuration, the Stratus ftServer attempts to boot from the array, instead of booting from the internal boot drive.

To avoid this issue before storage is correctly assigned, either boot the Stratus ftServer before connecting the fibre cables to the HBAs or, if connected to a fabric, disable the HBA ports on the switch before booting the ftServer.

After the system boots, connect the cables or reenable the switch ports. Verify the HBAs are logged in to the EMC CLARiiON array; then stop and restart the Navisphere® agent on the ftServer host. This will register the HBAs with the CLARiiON array and allow the HBA to properly detect the available LUNs.

---

## Matching the HBA with the correct PCI slot

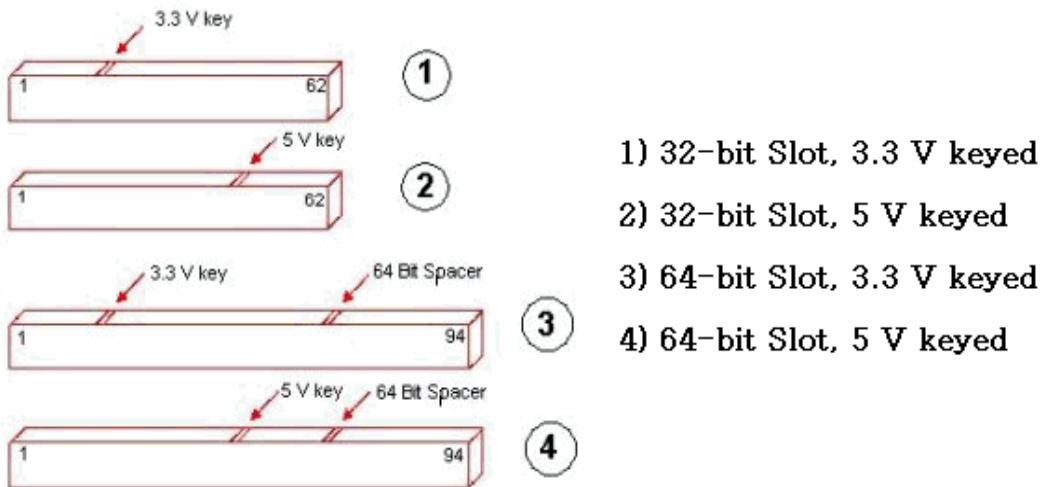
When choosing an HBA for your server, it is important to know which HBA is compatible with your server's PCI/PCI-X/PCI Express slots. Certain HBA models have specific voltage requirements or physical limitations that allow them to only work in specific slots.

Servers today have several different bus slot types for accepting HBAs. PCI, PCI-X, PCI-X 2.0, and PCI-Express.

PCI slots can be 32-bit and 64-bit (denoted by their 124-pin or 188-pin connectors). These slots have plastic "keys" that prevent certain HBAs from fitting into them. These keys work with the cutout notches in the HBA edge connector so that only compatible HBAs will fit into them. This is done because of the voltage characteristics

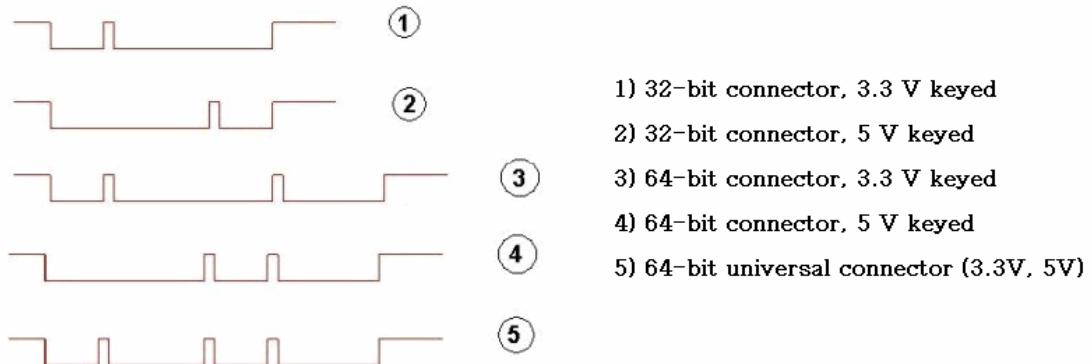
of the HBA. Inserting a 3.3v HBA into a 5v slot would cause severe damage to both the HBA and the server. Therefore, the slot keys denote the type of voltage provided by the slot and effectively prevent a voltage incompatible HBA from being inserted.

[Figure 2](#) shows how PCI slots will appear with their keys and what type of voltage is provided for each slot type.



**Figure 2** PCI slot types and voltage key locations

[Figure 3 on page 21](#) shows the HBA edge connectors compatible with the PCI slots shown in [Figure 1 on page 17](#). Note HBA #5 which shows a universal HBA edge connector. Universal HBAs are compatible with both 3.3v and 5v PCI slots.



**Figure 3 HBA edge connectors**

PCI-X (or PCI Extended) slots increase the speed that data travels over the bus. PCI-X slots appear identical to a 64-Bit PCI slot keyed for 3.3v. (Refer to number 3 in [Figure 2 on page 20](#) and [Figure 3](#).) PCI-X slots are backwards compatible with 3.3v PCI HBAs and universal HBAs. Inserting standard PCI HBAs into PCI-X slots will lower the bus speed, however, as they cannot take advantage of the improved performance.

PCI-X 2.0 is the next generation of PCI-X buses. PCI-X 2.0 increases the bus speed providing more performance for HBAs. PCI-X 2.0 slots also appear identical to a 64-bit PCI slot keyed for 3.3v. (Refer to number 3 in [Figure 2 on page 20](#) and [Figure 3](#).) PCI-X 2.0 is also fully backward-compatible with 3.3v PCI and PCI-X.

PCI Express (sometimes noted as PCIe) is a new bus type that uses the existing PCI model, but implements it in a faster, serial protocol. Because of the serial way it transmits data, the PCI Express bus slot can be different sizes depending on the throughput it supports. PCI Express slot speeds are expressed in "lanes" and are normally shown as x1, x4, x8, and x16. Each type of slot are different lengths ([Figure 4 on page 22](#)) and HBA edge connectors will also have varying lengths depending on how many lanes they require for throughput. Because of how PCI Express slots are keyed, an x1 HBA can be inserted in all 4 slot types as the HBA will negotiate with the slot to determine the highest mutually supported number of lanes. However, an HBA requiring x16 lanes will not fit into a smaller slot.

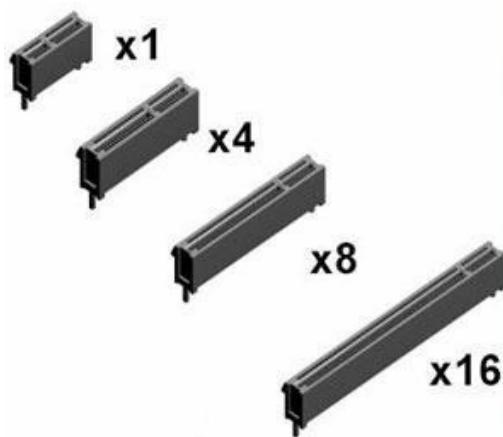


Figure 4 PCI Express slots

Figure 5 shows x1, x4, and x16 lane slots aligned on a mainboard. You can see how the slots are keyed so that low-lane HBAs can fit into larger slots.

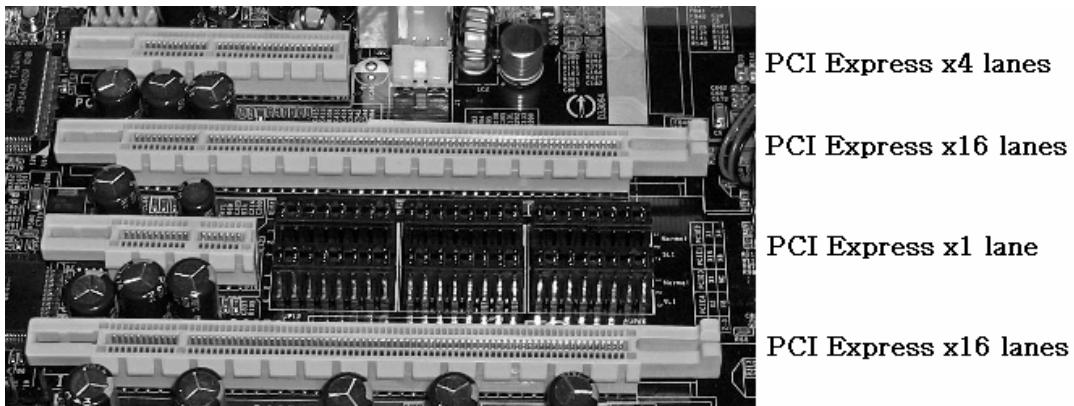


Figure 5 PCI Express slots aligned

QLogic offers HBAs for each bus/slot type available. [Table 1](#) shows each of the EMC-supported QLogic HBAs, and their respective slot requirements. Be sure to consult both your server user guide and QLogic to insure that the HBA you want to use is compatible with your server's bus.

**Table 1 EMC-supported QLogic HBAs**

HBA	PCI spec	BUS length	Power	Slot key
QLA2200F	PCI 2.1	64-bit	3.3V, 5V	Universal
QLA200	PCI-X 1.0a & PCI 2.2	32-bit	3.3V, 5V	3.3V
QLA210	PCI-X 1.0a & PCI 2.2	32-bit	3.3V	3.3V
QLA2310F	PCI-X 1.0a & PCI 2.2	64-bit	3.3V, 5V	Universal
QLA2340LF	PCI-X 1.0a & PCI 2.2	64-bit	3.3V, 5V	Universal
QLA2342LF	PCI-X 1.0a & PCI 2.2	64-bit	3.3V, 5V	Universal
QLE2360	PCI Express	x4 lane	3.3V	n/a
QLE2362	PCI Express	x4 lane	3.3V	n/a
QLA2460	PCI-X 2.0a & PCI 2.3	64-bit	3.3V	3.3V
QLA2462	PCI-X 2.0a & PCI 2.3	64-bit	3.3V	3.3V
QLE2460	PCI Express	x4 lane	3.3V	n/a
QLE2462	PCI Express	x4 lane	3.3V	n/a
QLE220	PCI Express	x4 lane	3.3V	n/a
QLE2560	PCI Express	x4 lane	3.3V	n/a
QLE2562	PCI Express	x4 lane	3.3V	n/a

Remember that some of the older HBAs are tall (also referred to as full-height) and may not fit into a server with a low-profile chassis. These factors must be considered before implementing your configuration to avoid unnecessary delays and possible equipment swaps or returns.

## Booting from the external storage array

If you are setting up your server to boot Windows from the external array, it is necessary to have the most recent BIOS installed on the HBA from which you plan to boot. BIOS is software that runs on the HBA. When configured, it presents a disk to the operating system from which to boot. During boot, the HBA driver is loaded and assumes control of the disk from the BIOS.

---

**Note:** If you are not planning to use the EMC array as a boot disk, these procedures can be skipped. Move on to the [“Installing the Windows operating system” on page 51](#).

---

First, install the BIOS to the HBA, and then configure it to boot from the EMC array.

---

### Create a floppy disk with the EMC-approved driver and BIOS

For the QLogic CD-ROM packaged with your HBA, select the driver for your Windows operating system. Be sure to select the **Legacy Install Kit** as this will allow you to extract the necessary driver files. The Legacy Install Kit is a .zip archive file. Unzip the files contained in the .zip archive onto a blank floppy disk.

BIOS for your HBA will also be provided on the QLogic CD-ROM. Note that the versions on the CD-ROM should already be installed on the HBA. If you are upgrading your firmware and/or BIOS, use the files on the CD-ROM or download the latest versions from the QLogic website following the procedure described in [“Downloading latest QLogic drivers/firmware/BIOS files” on page 16](#). Unzip the .zip archive files onto your floppy disk and keep the diskette handy during the installation procedures.

Necessary files for BIOS upgrades are: `flasutil.exe`, two files (.dat and .def) containing EMC-Approved NVRAM settings, and the correct .bin file. The .bin file is named `ql<xx>rom.bin` (where `xx` is the HBA family, i.e.: 23, 24). For example, BIOS for a qla2340 HBA would be `ql23rom.bin`. Also included in the BIOS archive is a .bat file, which is used to flash the new BIOS to the HBA and to apply the EMC NVRAM settings to the HBA.

---

**Note:** NVRAM is short for Non-volatile RAM. This is a special portion of memory on the HBA where HBA settings are stored.

---

**Note:** Driver and BIOS files may not fit on the same floppy. If you run out of disk space, use a single floppy disk for the driver files, and another disk for the BIOS files.

---

## Install/upgrade firmware and boot BIOS from DOS

To update using a DOS boot diskette:

1. Format a 3.5-inch diskette and extract the BIOS and NVRAM files from the archive file (.zip or self-extracting .exe) onto the diskette. Make sure `flasutil.exe` and the source files (BIN, DEF, DAT, and BAT files) are in the same directory. EMC-specific settings are contained in files named `emcXXXX.def` and `emcXXXX.dat` where `XXXX` is the model number of the HBA. These settings files (also referred to as NVRAM setting files) should also be in the same directory with the flash utility and source files. Note that some versions of BIOS may use different filenames depending on the version and HBA model.

Be sure to check the `readme` included with the BIOS files to make sure you have all of the appropriate files before proceeding to [Step 2](#).

2. Reboot your Windows host system using a DOS diskette.
3. At the `A:\>` prompt, insert the diskette that contains the QLogic BIOS files (created in step 1).
4. Run the included batch file at the command prompt. This is the file with the .BAT extension.

For example, QLA2340 HBAs have a batch file called `2340flsh.bat` or QLE2462 HBAs have a batch file called `eql2462.bat`. This batch file will automatically execute the necessary commands to flash the BIOS and NVRAM files to the board.

5. If you have other QLogic HBA models installed in the server, you may need to download additional BIOS packages and repeat [Step 1](#) through [Step 4](#) to update the BIOS' on those HBAs.

With the latest BIOS installed, configure and verify the BIOS settings to use the EMC storage array as the boot disk. Ensure that only a single I/O path to the LUN exists when installing the OS. A single HBA should have access to only a single array port at this point.

## QLogic Fibre Channel HBA BIOS/boot LUN settings

This section describes the steps required to configure a QLogic HBA boot BIOS for allowing an array-attached LUN to be used as a boot disk for the server.

This section assumes the following steps have been completed:

- ◆ The QLogic HBA's BIOS and NVRAM settings are updated to the latest version. Refer to "["Install/upgrade firmware and boot BIOS from DOS" on page 25](#)" for details.
- ◆ In direct-attach configurations, an HBA has a physical connection to the array port.
- ◆ In fabric-attach configurations, an HBA has a physical connection to the switch/fabric, and has been zoned to the array, so a single HBA to be used for boot has one logical I/O path to the array. Refer to your switch documentation for details.

Before configuring HBA settings to boot from an array-based LUN, your server's settings should be adjusted to disable booting from an internal system drive. The procedure for disabling boot from an internal system drive is largely dependent upon the server platform.

- ◆ In some instances, internal boot can be disabled via entering the onboard SCSI/RAID controller's BIOS utility. For example, an Adaptec based controller can be configured by pressing CTRL-A, when the Adaptec banner is displayed during Power-On Self Test (POST).
- ◆ Some servers will require entering the system BIOS utility to either disable boot from an internal drive, or to change the controller boot order, so the boot HBA is enumerated before the internal disk controller, allowing the array-attached LUN to be the first disk visible to the server. Refer to your server documentation for details.
- ◆ In some server instances, boot from an internal drive cannot be explicitly disabled. In this case, the internal drive(s) must be physically disconnected or removed from the server. Refer to your server documentation for details.



### **IMPORTANT**

In some cases, reinserting an internal drive (after having previously removed it and configured a HBA for boot) may result in the internal drive being re-enumerated as the first drive, and possibly modifying the boot order, such that the server will attempt to boot from the internal drive, rather than the intended array-based LUN. Ensure that appropriate precautions are taken to make sure the server will properly boot from an array-based LUN before reinserting an internal system drive.

### **Legacy (x86 and most EM64T-based servers) boot BIOS configuration**

During POST, the QLogic banner will be displayed.

1. Press **Ctrl+Q** to enter the Configuration utility:

```
QLogic Corporation
QLA2300/2310 PCI Fibre Channel ROM BIOS Version 1.47
Copyright (C) QLogic Corporation 1993-2004. All rights reserved.
www.qlogic.com

Press <CTRL-Q> for Fast!UTIL

BIOS for Adapter 0 is disabled
ROM BIOS NOT INSTALLED

<Alt-Q> Detected, Initialization in progress, Please wait...
```

**Figure 6      QLogic banner**

2. Select the HBA (enumerated by its I/O address) to be used for boot.

If multiple HBAs are installed, there will be multiple HBA entries. The order of the HBA instances listed is the order they will be scanned for a boot device; (note that this does not necessarily correspond to PCI slot numbering), and press **Enter**.

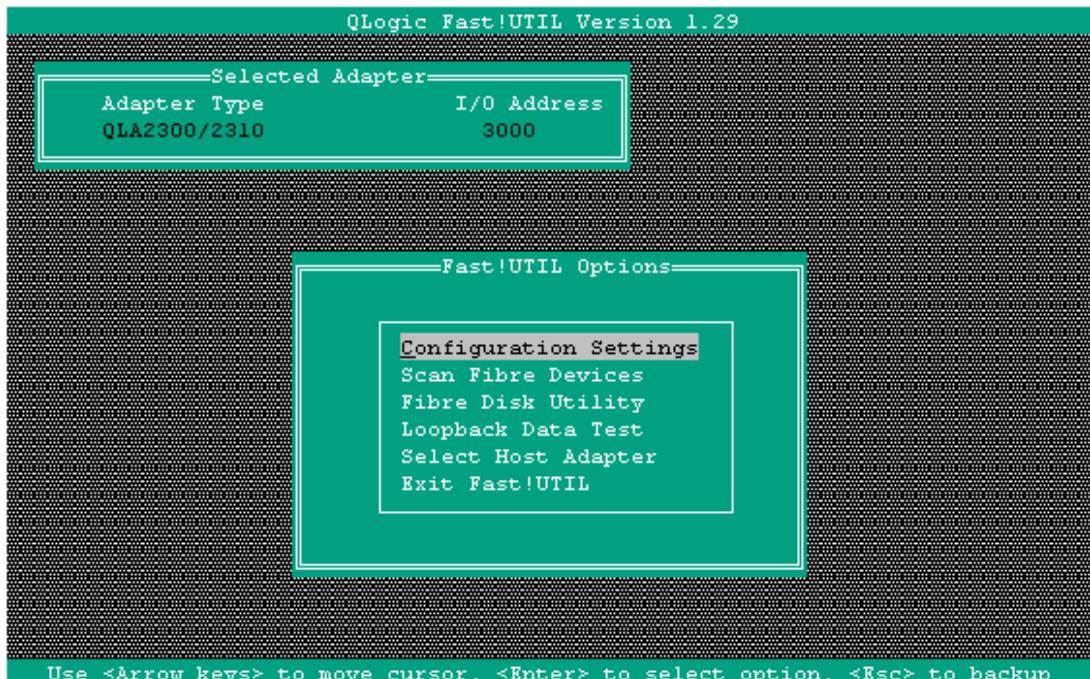


Figure 7 Main Fast!UTIL options window

3. Select **Configuration Settings** from the main **Fast!UTIL Options** dialog, and press **Enter**.

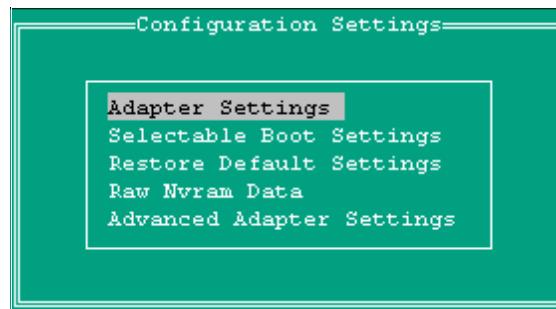


Figure 8 Configuration Settings window

4. Select **Adapter Settings** from the **Configuration Settings** window and press **Enter**.

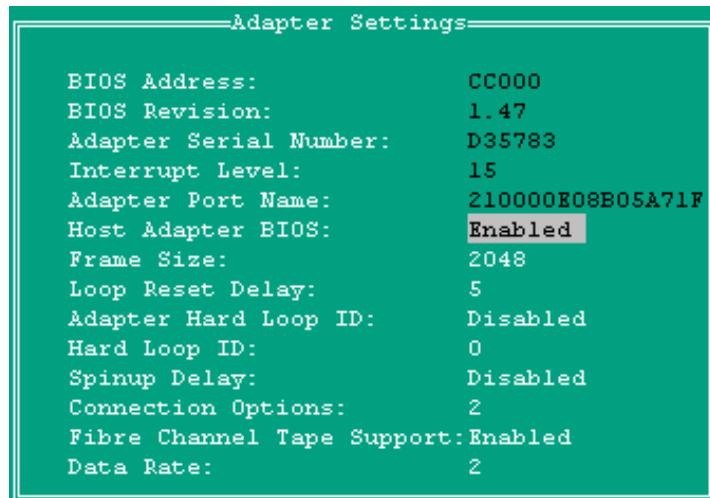


Figure 9 Adapter Settings window

5. The Host Adapter BIOS setting is **Disabled** by default; select this setting and press **Enter** to enable Host Adapter BIOS.

Press **Esc** to return to the previous **Configuration Settings** (as shown in [Figure 8 on page 28](#)).

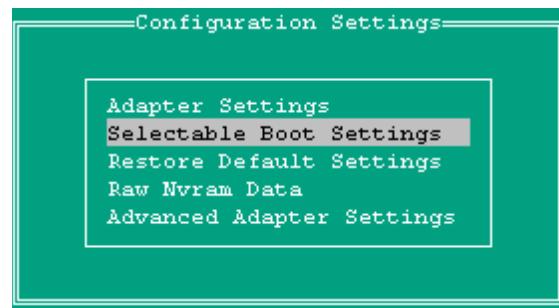


Figure 10 Configuration Settings window

6. From the **Configuration Settings** dialog, select **Selectable Boot Settings** and press **Enter**.

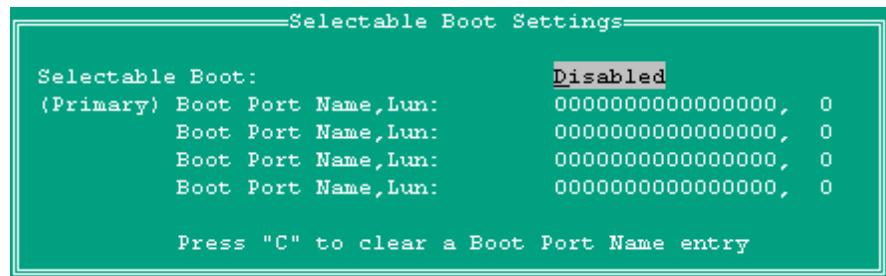


Figure 11 Selectable Boot Settings window

7. **Selectable Boot** is **Disabled** by default. Select this setting and press **Enter** to enable **Selectable Boot**.
8. Scroll down to the **(Primary) Boot Port Name, LUN:** setting, and press **Enter**.

The **Fast!UTIL** will now scan for attached FC devices (as shown in [Figure 12 on page 31](#)). If physical connectivity to the array is setup properly via zoning, then the array port will be found after this scan. Use the **<PageUp>** and **<PageDown>** keys to navigate the list of target IDs for the array port being used for boot.

Select Fibre Channel Device					
ID	Vendor	Product	Rev	Port Name	Port ID
128		No device present			
<u>129</u>	<u>EMC</u>	<u>SYMMETRIX</u>	<u>5670</u>	<u>5006048ACCC8321E</u>	<u>2C2B00</u>
130		No device present			
131		No device present			
132		No device present			
133		No device present			
134		No device present			
135		No device present			
136		No device present			
137		No device present			
138		No device present			
139		No device present			
140		No device present			
141		No device present			
142		No device present			
143		No device present			

Use <PageUp/PageDown> keys to display more devices

Figure 12 Select Fibre Channel Device window

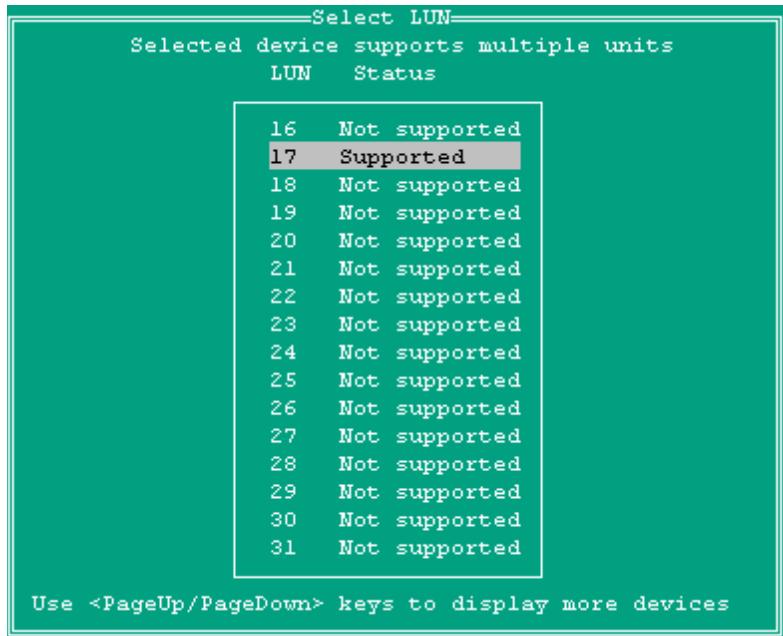
If no entries appear at any target IDs, verify the following:

- If multiple HBAs are present, verify the HBA select in the BIOS Utility is the same that currently provides the I/O path to the storage (at this point, only one I/O path should be configured to the boot LUN).
- For CLARiiON arrays, verify that the single I/O path points to the SP which owns the boot LUN.
- For FC-SW environments, verify fabric zoning parameters, so a single I/O path exists to the boot LUN. Refer to array software documentation for details.
- Check physical FC connectivity between the HBA and array (direct attach environment) or switch (FC-SW environment).

9. Select the array port to be used for boot, and press **Enter**.

If LUNs are allocated to the HBA (using LUN Masking schemes, such as Access Logix™ or Volume Logix), they will be presented at their LUN number.

For example, [Figure 13](#) shows that LUN 17 is masked to the HBA. The LUN is available and is presented as "Supported" by the BIOS.



**Figure 13 Example of LUN 17 allocated to HBA**

If no numbered entries appear in the above figure, verify the following:

- For CLARiiON arrays, verify the single I/O path points to the SP that owns the boot LUN.
- Verify array LUN masking settings are configured so this HBA has visibility to the appropriate LUN. Refer to array software documentation for details.

10. Select a supported LUN to use as the boot LUN (shown as LUN 17 in [Figure 13](#)) and press **Enter**.

The **Selectable Boot Settings** dialog is displayed ([Figure 14 on page 33](#)) with the updated array port and LUN number as the boot device.

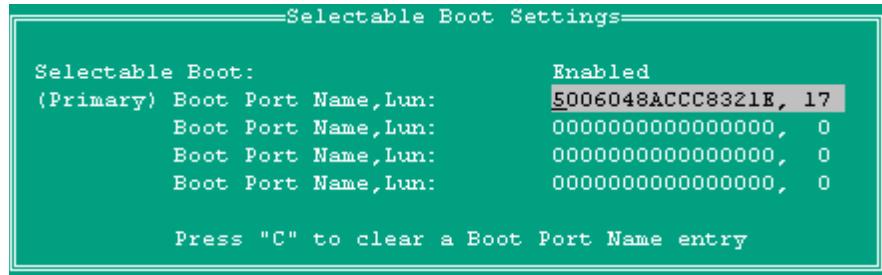


Figure 14 Selectable Boot Settings window

11. Press **Esc** to return to the previous **Configuration Settings** dialog.
12. Press **Esc** on the **Configuration Settings** dialog.

A dialog will appear to warn of a configuration change (as shown in [Figure 15](#)).

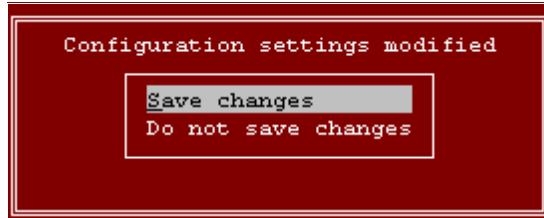


Figure 15 Warning dialog

13. If the settings are correct, select **Save changes** to return to the initial **Fast!UTIL Options** dialog.

Otherwise, press **Esc** to make additional changes, or select **Do not save changes** and press **Enter** to return to the initial **Fast!UTIL Options** window (as shown in [Figure 16 on page 34](#)).

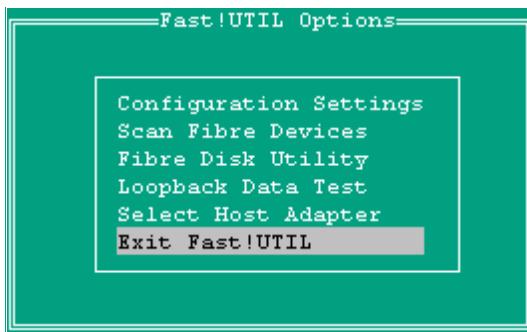


Figure 16 Fast!UTIL Options window

14. To exit the **Fast!UTIL** configuration utility, select **Exit Fast!UTIL** and press **Enter**.

The system will now reboot.

During the subsequent reboot, the QLogic BIOS banner screen should show the array and LUN specified as a boot-capable LUN (as shown in [Figure 17](#)).

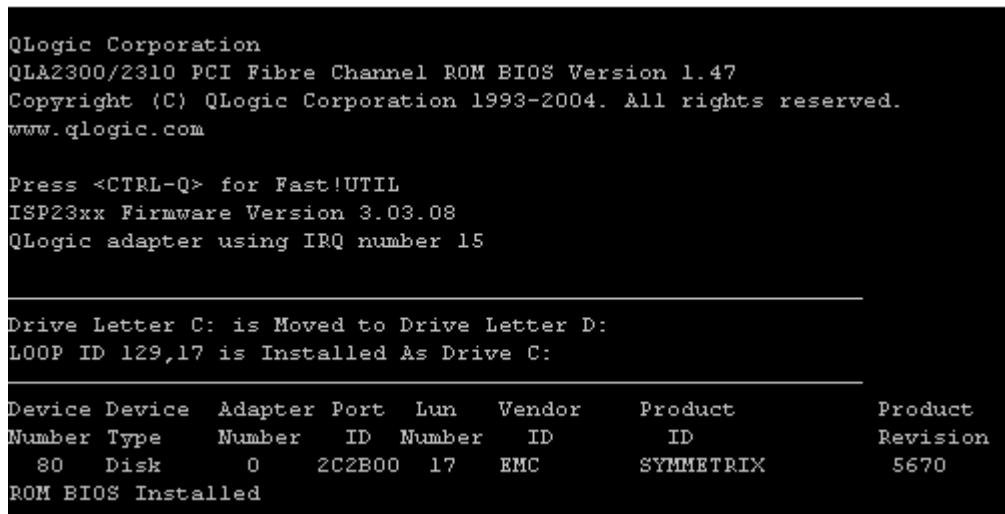


Figure 17 Typical QLogic BIOS banner screen

At this point, the OS installation can begin using this LUN as the boot volume.

**Pre-configured settings** The following parameters have been preconfigured in the EMC NVRAM settings file. They are also configurable in the Host Adapter Settings, Advanced Adapter Settings, and Extended Firmware Settings menus. These menus and selections, when viewed in SANSurfer v2.0.25 and later, may appear under different headings.

**Table 2** Pre-configured parameters

Parameter	QLogic default setting	EMC-approved setting
Data Rate	0 (1 Gb/s)	2 (Auto Select)
Execution Throttle	16	256
Connection options (topology)	2 (Loop preferred, otherwise point-to-point)	2 (Loop preferred, otherwise point-to-point)
Loop Reset Delay	5	5
Enable LIP Full Login	Yes	Yes
Enable Target Reset	No	Yes
Port Down Retry Count	8	45
Link Down Timeout	30	45
Luns Per Target	8	256
Adapter Hard Loop ID	Enabled	Disabled
Hard Loop ID	0	0
Descending Search LoopID	0	1
Operation Mode	0	0
Interrupt Delay Timer	0	0
Enable Interrupt (24xx HBAs)	No	No

#### EFI (IA64 Itanium and some x64 servers) system firmware configuration

1. Prior to booting the server, ensure that media (USB memory drive, CD-ROM, or floppy) which contains the QLogic EFI boot code/utility is physically present in the system.
2. Following POST of the server, the **Firmware Boot Manager** (similar to [Figure 18 on page 36](#)) menu will be displayed.

Using the arrow keys, select the option for **EFI Shell** and press **Enter**.

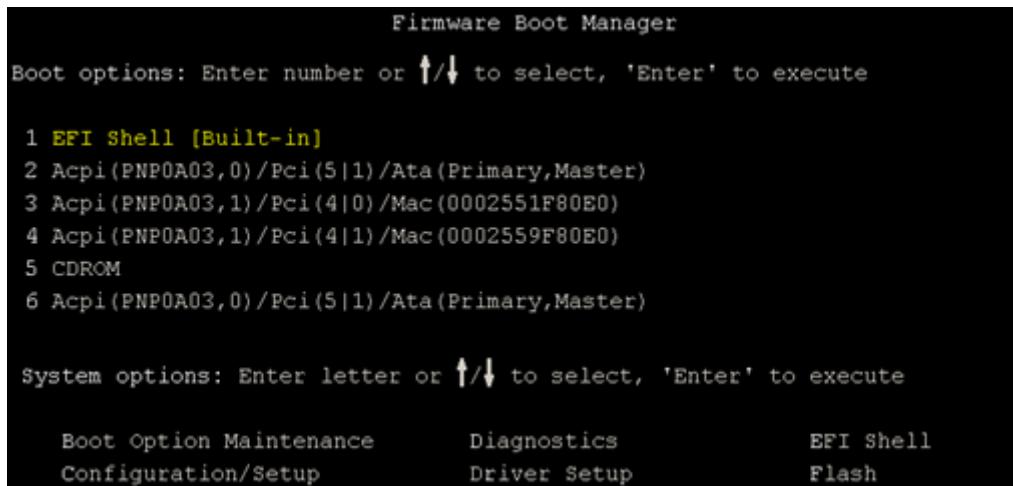


Figure 18 Firmware boot manager menu

- The EFI shell will open, and the Device Mapping Table may be listed by default (similar to [Figure 19](#)). If the Device Mapping Table is not listed, type **map** and press **Enter**.

```
Device Mapping Table
fs0  : MemMap(15:FF000000-FFFFFFF)
fs1  : MemMap(8:FF800200-FFBFFFFFF)
fs2  : MemMap(16:1B846000-1B9ADFFFF)
fs3  : Acpi(PNPOA03,0)/Pci(5|1)/Ata(Primary,Master)/CDROM(Entry0)
fs4  : Acpi(PNPOA03,0)/Pci(5|1)/Ata(Primary,Master)/CDROM(Entry1)
fs5  : Acpi(PNPOA03,0)/Pci(5|3)/Usb(0, 0)/HD(Part1,Sig19EBC514)
fs6  : Acpi(PNPOA03,1)/Pci(3|0)/Scsi(Pun0,Lun0)/HD(Part1,SigFA5B03C0-EA5E-01C3
-507B-9E5F8078F531)
blk0 : MemMap(15:FF000000-FFFFFFF)
blk1 : MemMap(8:FF800200-FFBFFFFFF)
blk2 : MemMap(16:1B846000-1B9ADFFFF)
blk3 : Acpi(PNPOA03,0)/Pci(5|1)/Ata(Primary,Master)
blk4 : Acpi(PNPOA03,0)/Pci(5|1)/Ata(Primary,Master)/CDROM(Entry0)
blk5 : Acpi(PNPOA03,0)/Pci(5|1)/Ata(Primary,Master)/CDROM(Entry1)
blk6 : Acpi(PNPOA03,0)/Pci(5|3)/Usb(0, 0)
blk7 : Acpi(PNPOA03,0)/Pci(5|3)/Usb(0, 0)/HD(Part1,Sig19EBC514)
blk8 : Acpi(PNPOA03,1)/Pci(3|0)/Scsi(Pun0,Lun0)
blk9 : Acpi(PNPOA03,1)/Pci(3|0)/Scsi(Pun0,Lun0)/HD(Part1,SigFA5B03C0-EA5E-01C3
-507B-9E5F8078F531)
blkA : Acpi(PNPOA03,1)/Pci(3|0)/Scsi(Pun0,Lun0)/HD(Part2,SigFA9CA0A0-EA5E-01C3
-F1B3-12714F758821)
blkB : Acpi(PNPOA03,1)/Pci(3|0)/Scsi(Pun0,Lun0)/HD(Part3,Sig5CE668E0-7CC6-01C5
-A1F4-04622FD5EC6D)
fs5:\> |
```

**Figure 19      Device mapping table**

- The file systems available to the server are listed in the Device Mapping Table, referenced by **fsN**, where *N* is a different number for each available file system. The description next to the **fsN** entry references the type of media on which the file system resides.

In the example shown in [Figure 19](#):

- **fs0**, **fs1** and **fs2** refer to memory ramdisks
- **fs3** and **fs4** refer to file systems on a CD inserted in the CD-ROM
- **fs5** refers to a file system on aUSB memory drive
- **fs6** refers to an existing file system on an internal hard drive.

- The file system you select depends upon what media contains the QLogic EFI boot code/utility. In this example, the QLogic EFI boot code/utility resides on the USB memory drive.

3. Point the EFI shell to the proper file system by typing **fsN:** (where *N* is the number which references the proper file system) followed by **Enter**.
4. Before loading the QLogic EFI boot code/driver to the HBA(s), ensure that any old EFI boot code loaded in the system has been removed. Type **drivers** at the EFI shell prompt and press **Enter**.
  - a. Look for any driver listings that reference "QLogic Fibre Channel Adapter," similar to the listing shown in [Figure 20](#)



```
60 00000140 D X X 1 - QLogic Fibre Channel Driver          PciRom Seg=00000000
```

**Figure 20 Reference to QLogic Fibre Channel driver**

- b. If such a driver entry exists in the output, it should be removed before installing the current driver. Make note of the first two digits on the line which references the QLogic Fibre Channel Driver ("60" in the example shown in [Figure 20](#)); this is the "driver handle". Type **unload <driver handle>**.

For the example shown in [Figure 20](#), **unload 60** would be used to remove the EFI driver. The system will prompt to "Unload Protocol Image (y/n)?". Type **y** and press **Enter**. The existing QLogic EFI driver will now be removed.

5. Type **dir** and press **Enter** to list the contents of the directory. If the directory contents are not consistent with what you expect, and do not appear to contain the QLogic boot code/utility, the file system select may be incorrect.
6. Verify the proper file system has been selected. If the QLogic boot code/utility resides in a subdirectory, type **cd subdirectory** and press **Enter**.

```
fs0:\qlogic> dir
Directory of: fs0:\qlogic

12/01/05  11:29a <DIR>          2,048  .
12/01/05  11:29a <DIR>            0  ..
08/10/04  01:11p          136,704  efiaux.drv
08/10/04  09:44a      r    272,415  EfiCfg.pdf
07/24/04  05:13p          295,936  efiutil.efi
04/29/04  02:03p          259,600  EfiUtil.pdf
08/18/04  03:41p      r    12,287  nvram23.dat
08/10/04  01:13p          55,296  ql2312ef.bin
08/10/04  01:13p          72,192  ql2312fw.bin
08/18/04  03:49p      r    12,842  qlefireadme.txt
08/18/04  04:25p          2,615  ReleaseNotes.txt
               9 File(s)   1,119,887 bytes
               2 Dir(s)

fs0:\qlogic> █
```

Figure 21 QLogic directory

- The directory listing should contain the QLogic EFI boot code/utility downloaded to the media (as shown in Figure 21).
- The files of importance will take the following form:

**EFIutil.efi** QLogic EFI utility for updating adapter driver/firmware.

**qlxxxxx.drv** EFI driver for QLogic (used by EFIutil when the driver has not been flashed to the HBA.)

**qlxxxxxxxx.bin** EFI boot driver image file package. Flashed to the HBA to cause the EFI boot driver to load automatically during system start-up.

7. Type **efiutil** and press **Enter**.

```
Fibre Channel Card Efi Utility 1.32 (7/19/2004)
QLogic Fibre Channel Adapter (driver 1.42, firmware 0.00.000)  AUX
QLogic Fibre Channel Adapter (driver 1.42, firmware 0.00.000)  AUX

2 Fibre Channel Adapters found:

Adapter      Path          WWN      Driver (Firmware)
A0  Acpi(PNPOA03,4)/Pci(3|0)  210000E08B0955A7  1.42 (0.00.000)
A1  Acpi(PNPOA03,4)/Pci(3|1)  210100E08B2955A7  1.42 (0.00.000)

efiutil> ■
```

**Figure 22 Fibre Channel Card Efi utility**

The QLogic HBA(s) installed in the server will be listed (as shown in [Figure 22](#)). Note the "firmware" version listed in the utility. If the firmware is listed as a specific version (not a series of zeroes), and "AUX" is not listed next to the firmware field at the top of the report then the EFI driver and firmware have been loaded on the HBA(s); proceed to the section immediately following [Figure 25 on page 43](#).

If the firmware is listed as a series of zeroes, and "AUX" is listed next to the firmware field at the top of the report (as shown in [Figure 22](#)), this indicates the EFI boot code has not yet been installed on the HBA(s). Proceed as follows:

**To install the EFI boot code driver and non-volatile RAM settings on the HBA(s):**

The EFI boot code driver must be loaded onto the HBA(s) in order to be used by the EFI BIOS.

1. Type **update.nsh <xxxxxxxx.bin>**, inserting the name of the EFI boot driver package (bin file). The update procedure with run and appear similar to the output shown in [Figure 22](#).
2. Press **Enter**.

```
fs0:\qlogic> efiutil all ew=ql2312ef.bin
Fibre Channel Card Efi Utility 1.32 (7/19/2004)
QLogic Fibre Channel Adapter (driver 1.40, firmware 0.00.000)  AUX
QLogic Fibre Channel Adapter (driver 1.40, firmware 0.00.000)  AUX

2 Fibre Channel Adapters found:

Adapter      Path          WWN      Driver (Firmware)
A0  Acpi(PNPOA03,4)/Pci(3|0) 210000E08B0955A7  1.40 (0.00.000)
A1  Acpi(PNPOA03,4)/Pci(3|1) 210100E08B2955A7  1.40 (0.00.000)

A0  Acpi(PNPOA03,4)/Pci(3|0) 210000E08B0955A7  1.40 (0.00.000)
Writing efi driver image to flash from file ql2312ef.bin...
Old revision 1.40, New revision 1.40
File size 0000D800
WARNING: do NOT interrupt this operation...
Flash part Am29LV010
Writing new image...
.....
.....
Reinitializing adapter A0...
Image write complete.

A1  Acpi(PNPOA03,4)/Pci(3|1) 210100E08B2955A7  1.40 (0.00.000)
Writing efi driver image to flash from file ql2312ef.bin...
Old revision 1.40, New revision 1.40
File size 0000D800
WARNING: do NOT interrupt this operation...
Flash part Am29LV010
Writing new image...
.....
.....
Reinitializing adapter A1...
Image write complete.

fs0:\qlogic> █
```

Figure 23 QLogic efiutil all upgrade

- The utility will upgrade EFI boot code drivers on all HBAs installed in the server and return to the EFI shell when complete (as shown in [Figure 23](#)). If any errors are reported during this process, verify that the correct EFI boot code driver for your HBA has been copied to your installation media.

3. The appropriate NVRAM settings must now be loaded onto the HBA(s). Type **efiutil all nr=nvram23.dat** (nvram23.dat is the default NVRAM data file for QLA23xx-based HBAs). Press **Enter**.

```
fs0:\qlogic> efiutil all nr=nvram23.dat
Fibre Channel Card Efi Utility 1.32 (7/19/2004)

2 Fibre Channel Adapters found:

Adapter      Path          WWN          Driver (Firmware)
A0  Acpi(PNP0A03,4)/Pci(3|0) 210000E08B0955A7 1.40 (3.03.001)
A1  Acpi(PNP0A03,4)/Pci(3|1) 210100E08B2955A7 1.40 (3.03.001)

A0  Acpi(PNP0A03,4)/Pci(3|0) 210000E08B0955A7 1.40 (3.03.001)
Writing nvram from file nvram23.dat...
.....
Done.

A1  Acpi(PNP0A03,4)/Pci(3|1) 210100E08B2955A7 1.40 (3.03.001)
Writing nvram from file nvram23.dat...
.....
Done.

fs0:\qlogic> |
```

**Figure 24 Data loaded onto HBA(s) installed in server**

- The NVRAM data will be loaded onto the HBA(s) installed in the server (as shown in [Figure 24](#)), and return to the EFI shell when complete.
- If any errors are reported during this process, verify that the correct NVRAM data file (nvram23.dat) for your HBA has copied to your installation media.

4. Type **reset** at the EFI shell prompt to reboot the server, allowing the updated drivers, firmware, and NVRAM settings to take effect.
5. Following the reboot, type **fsN:** (where N is the number which references the proper file system, as described earlier).
6. Press **Enter** to access the file system containing the QLogic EFI boot code.
  - If the EFI boot code resides in a subdirectory, type **cd <subdirectory name>** and press **Enter**.
7. Type **efiutil** to start the QLogic EFI Utility and press **Enter**.

- At this point, the QLogic HBA instances should be shown with a specific firmware version, and "AUX" should not be listed next to the firmware, as shown in [Figure 25](#).
- At this point, the EFI drivers, firmware, and NVRAM settings have loaded to the HBA(s).

```
fs0:\qlogic> efiutil

Fibre Channel Card Efi Utility 1.32 (7/19/2004)

2 Fibre Channel Adapters found:

Adapter      Path          WWN      Driver (Firmware)
A0  Acpi(PNP0A03,4)/Pci(3|0)  210000E08B0955A7  1.40 (3.03.001)
A1  Acpi(PNP0A03,4)/Pci(3|1)  210100E08B2955A7  1.40 (3.03.001)

efiutil> █
```

**Figure 25** QLogic HBA instances with specific firmware version

8. Type **q** and press **Enter** to exit the QLogic EFI Utility.
9. At the EFI shell prompt, type **drivers** and press **Enter**. Note the entries that reference "QLogic Fibre Channel Adapter" are similar to the listing shown in [Figure 26](#).

```
5F 00000140 D X X 1 - QLogic Fibre Channel Driver          PciRom Seg=00000000
60 00000140 D X X 1 - QLogic Fibre Channel Driver          PciRom Seg=00000000
```

**Figure 26** QLogic Fibre Channel drivers

10. Make note of the first two digits (referred to as the "driver handle") on the line that references the "QLogic Fibre Channel Driver". If multiple HBAs are installed in the server, there will be multiple entries, as shown in [Figure 26](#).

The order of the HBA instances listed is the order in which they have been enumerated by the system. This does not necessarily correspond to PCI slot numbering. In this example, the two QLogic HBAs installed in the server are using driver handles 5F and 60, respectively.

- a. Type **drvcfg**.
- b. Press **Enter**.

```
fs0:\qlogic> drvcfg
Configurable Components
  Dev[33]  Ctrl[46]  Lang[eng]
  Dev[3F]  Ctrl[53]  Lang[eng]
  Dev[3F]  Ctrl[54]  Lang[eng]
  Dev[4F]  Ctrl[51]  Lang[eng]
  Dev[4F]  Ctrl[52]  Lang[eng]
  Dev[5F]  Ctrl[62]  Lang[eng]
  Dev[60]  Ctrl[63]  Lang[eng]

fs0:\qlogic> ■
```

Figure 27 Driver handle numbers

11. Find the driver handle numbers that correspond to those listed for the QLogic HBAs (as shown in [Figure 27](#)). Note the two digits (preceded by **Ctrl**, as shown in [Figure 27](#)) next to the driver handles for the QLogic HBAs. These are control handles.
12. Determine the HBA instance that will be used for boot, and enter the **QLogic Fibre Channel Driver Configuration Utility** by typing **drvcfg -s <driver handle> <control handle>** (where driver handle and control handle are the values that correspond to the HBA instance to be used for boot. In this example, "drvcfg -s 5f 62" is used.)
13. Press **Enter**.

The **Fibre Channel Driver Configuration Utility** menu will be displayed (as shown in [Figure 28 on page 45](#)).

```
Fibre Channel Driver Configuration Utility

NOTE: Do not redirect console output to a file.

Main Menu

  NVRAM Parameters
    1. Edit Adapter Settings
    2. Edit Advanced Settings
    3. Edit Database
    4. Edit Boot Settings
  Information
    5. Show Database
    6. Show Translation
    7. Show NVRAM Buffer
    8. Info
    9. Help
  Operation
    10. Abandon
    11. Write
    12. Quit

Enter a Selection: █
```

Figure 28 Fibre Channel driver configuration utility

14. Type 1 (Edit Adapter Settings) and press Enter.

```
Edit Adapter Settings

  0. Previous Menu
  1. Enable Hard Loop Id [n]
  2. Hard Loop Id (hex) [0]
  3. Reset Delay (dec) [5]
  4. Enable FC Tape [y]
  5. Frame Size [2048]
  6. Connection Option [Loop Preferred, Otherwise Point To Point]
  7. Data Rate [Auto]

Enter a Selection: █
```

Figure 29 Edit adapter settings

- By default, option 1 (**Enable Hard Loop ID**) is disabled.
- In FC-SW environments, the default of disabled is the proper setting.

Select **2. Auto Topology: Pt to Pt first**.

Press **Enter** when your choice has been selected. The **Topology** information toward the top of the screen will reflect your selection.

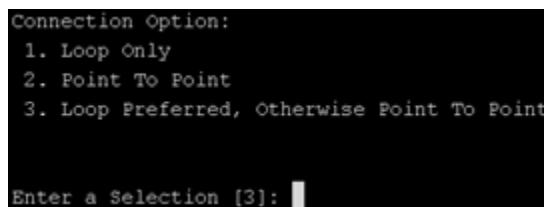
Press **<Escape>** to return to the previous configuration window.

- In FC-AL/"direct attach" environments, Hard Loop ID should be enabled.

Type **1** and press **Enter**. The utility will prompt to **Enable Hard Loop Id [n]?**.

Type **y** and press **Enter**. **Enable Hard Loop Id** will now be shown as **[y] (enabled)**.

Type **0** and press **Enter** to return to the previous menu as shown in [Figure 28 on page 45](#).



**Figure 30** Connection option

- By default, option 6 (Connection option) setting of **Loop Preferred, Otherwise Point To Point**, is acceptable for most configurations, and will auto-detect the connection topology.
- To manually set the connection topology, type **6** and press **Enter**. Otherwise, type **0** and press **Enter** to return to the previous menu as shown in [Figure 28 on page 45](#).
- In FC-SW environments, **Point To Point** is the appropriate setting. In FC-AL/"direct attach" environments, **Loop Only** should be selected.

Type the appropriate selection and press **Enter**. The selected connection topology will now be reflected.

Type **0**.

Press **Enter** to return to the previous menu as shown in [Figure 28 on page 45](#).

- Option 3 (Edit Database) allows the appropriate WWN of the array port, and the LUN address, to be specified for boot.

```
Enter a Selection: 3
Entry in WWN database to edit [0-4]? 0
Entry 0 Port WWN [0000000000000000]? 5006048ACD20165E
Node WWN [0000000000000000]? 5006048ACD20165E
Lun (hex) [00]? 1A

Entry in WWN database to edit [0-4]? 1
```

**Figure 31 Example array port WWN and LUN values**

Type **3** and press **Enter**.

Select **0** to select the first WWN database entry.

Press **Enter**.

The utility prompts for **Entry 0 Port WWN**.

15. Type the full WWN of the array port being used for boot and press **Enter**.

The utility prompts for **Node WWN**.

16. Enter the same WWN used above and press **Enter**.

The utility prompts for the hexadecimal LUN address to be used for boot;

17. Type the appropriate hexadecimal LUN value to be used for boot and press **Enter**. [Figure 31](#) shows example array-port WWN and LUN values.

---

**Note:** This utility does not explicitly check the values entered for validity, care must be taken to ensure that the proper array port WWN and LUN addresses have been entered.

---

The utility will prompt for another WWN database entry to modify,

18. Press **Enter** to return to the menu as shown in [Figure 28 on page 45](#).
19. Save the configuration changes by typing **11** (Write) and press **Enter**.

The utility reports that it is done saving changes

20. Press any key to continue, and then **12** to exit the utility.

The system reports that options have been set, as shown in [Figure 32](#).

```
Drv[5F] Ctrl[62] Lang[eng] - Options set. Action Required is Press [ENTER]
to continue
```

**Figure 32 Options set**

21. Press **Enter** to return to the EFI shell. Type **reset** to reboot the server to enable the changes.

22. Following the reboot, open the EFI shell. The **Device Mapping Table** may be listed by default (similar to [Figure 19 on page 37](#)).

- If the **Device Mapping Table** is not listed, type **map** and press **Enter**.

```
blkB : Acpi(PNP0A03,1)/Pci(3|0)/Scsi(Pun0,Lun0)/HD(Part3,Sig5CE668E0-7CC6-01C5
-A1F4-04622FD5EC6D)
blkC : Acpi(PNP0A03,4)/Pci(3|0)/Fibre(WWN5006048ACD20165E,Lun0)
blkD : Acpi(PNP0A03,4)/Pci(3|0)/Fibre(WWN5006048ACD20165E,Lun1A000000000000)
Shell> [ ]
```

**Figure 33 Example blkD as array port**

- Note any entries starting with **blk** (block-level devices, such as volumes) which reference a Fibre interface (as shown in [Figure 33](#)). The entry should list the array port WWN and LUN address specified in the configuration utility. [Figure 33](#) shows entry **blkD** as the array-port WWN and LUN specified during configuration. This is the EFI entry that specifies the specific array LUN to use for boot.

---

**Note:** The example shown in [Figure 33](#) also shows **BlkC** as **Lun0**. This is a Symmetrix®-based, read-only Volume Logix Database device used for LUN masking and cannot be used for boot, even though it is still detected by the QLogic EFI driver and is reported as visible.

---

At this point, the OS installation can begin using this LUN as the boot volume.

## Verifying array/LUN visibility for boot

Verification of the HBA ability to access the boot LUN, and boot BIOS settings is recommended before installing the OS. Care must be taken to ensure that only a single I/O path to the LUN exists when installing the OS, a single HBA should have access to only a single array port at this point. Selecting BIOS and Boot LUN configuration settings vary with HBA vendor.

Refer to your array documentation for details on verifying HBA connectivity.

## Installing a RAMDISK under the EFI shell

Intel provides an EFI toolkit on the Intel website <http://www.intel.com/technology/efi>. Included in the EFI toolkit is the RAMDISK driver. To install the RAMDISK driver on your system, copy the RAMDISK.EFI file to your USB flash drive.

Insert the USB flash drive in your EFI-based server's USB port and boot the server to the EFI shell. At the shell prompt, locate your USB flash drive in the device mapping table. A line similar to the following should be listed in the mapping table:

```
Fs0: Acpi (PNPOA03,0)/Pci (1D|1)Usb(1,0)/HD(Part1,Sig0D0C0B0A)
```

Switch to the USB flash drive by typing in the corresponding FS number, followed by a colon (i.e., Fs0:) and press **Enter**.

At the FS prompt, type **Load RAMDISK.EFI** and press **Enter**. You should see the message noting that the driver has loaded successfully.

To locate the new RAMDISK, type **Exit** and press **Enter**. From the system Boot Manager menu, select **EFI Shell** to go back to the EFI Shell. The device map should now show a new FS device as well as the previous USB device.

---

**Note:** The order of the devices may have shifted with the discovery of the RAMDISK.

---

```
Fs0: VenMsg (06ED4DD0-FF78-11D3-BDC4-00A0C94053D1)
Fs1: Acpi (PNP0A03,0)/Pci (1D|1)/Usb(1,0)/HD(Part1,Sig0D0C0B0A)
```

In the above example, the RAMDISK is now Fs0. Now you can copy your driver files for your HBA to the RAMDISK. Switch to your USB flash drive with the driver files and copy the files to the RAMDISK by

using the **copy** command. As with DOS, the copy command can use an asterisk to grab multiple files, (i.e., `Copy *.* fs0:.`).

Once the files are copied to the RAMDISK, you may proceed to install Windows.

---

**Note:** If the server is rebooted at any time, this procedure will need to be repeated as the RAMDISK is deleted during a reboot.

---

## Installing the Windows operating system

This section provides procedures for installing Windows 2000/2003 and Windows 2008 operating systems.

- ◆ [“Windows 2000/2003 external boot disk installation,”](#) next
- ◆ [“Windows 2008 internal/external boot disk installation”](#) on [page 59](#)

### Windows 2000/2003 external boot disk installation

This section is a step-by-step procedure for installing Windows 2000/2003 Operating System to either an internal or external boot device.

After you have your HBA(s) installed in your server, and configured for external boot if necessary, the next step is to install the Windows operating system. If you intend to boot to an external device please refer to [“Booting from the external storage array”](#) on [page 24](#) for setting the boot BIOS for external boot and selecting the external boot lun. If your system is EFI-based refer to [“Installing a RAMDISK under the EFI shell”](#) on [page 49](#). Also refer to your server’s documentation for preparing your server for external boot.

---

**Note:** If you intend to boot to an external disk, only present the LUN that you intend to boot from. All additional luns can be added after the installation. This will eliminate any confusion on selecting the correct partition for installation and eliminates any problems that the Operating System could encounter on reboot during the installation. Also confirm there is only **one** path to the storage array. Having more than one path can cause the operating system to fail during the installation.

You need the following materials to install Windows:

- ◆ A Windows CD-ROM for the Windows version you wish to install
- ◆ AN EMC-approved HBA driver diskette for Windows, or an EFI RAMDisk if it is an EFI based install

---

**Note:** If you are using QLogic STORPort driver 9.1.7.16 or later on Windows 2003, and are booting externally to an EMC array, you will need to install using driver version 9.1.4.15. Driver version 9.1.7.16 and later require a minimum of Windows 2003 with Service Pack 2 and STORPort hotfix Q932755. Since these required patches/QFEs do not come preinstalled on the Windows 2003 installation CD-ROM, you must install using the older driver version, and then upgrade to 9.1.7.16 or later after installing the correct service pack and QFE.

---

**To install Windows:**

1. Insert a bootable Windows CD-ROM in the drive and reboot the system. If your system has a bootable disk already configured from a previous installation, the software will prompt you to press any key to boot from CD-ROM.
2. If you are installing Windows to boot from an external array disk, you will need to supply setup with the HBA driver. To do this, immediately after the Windows installation begins, press **F6** when directed or when the blue screen appears. Otherwise, proceed to step 6.

Pressing **F6** tells the Windows installer you want to load a third-party driver before proceeding with the installation.

If you do not press **F6** in time to add the drivers, restart the server and try again. You will know if you missed the **F6** function to install third-party drivers when the setup returns with a warning that it cannot find a partition to load the operating system



Figure 34 Windows Setup screen with F6 prompt

Note: Windows 2000 does not display the F6 prompt.

3. When prompted for additional drivers, select **S (Specify Additional Device)**.

Windows Setup

Setup could not determine the type of one or more mass storage devices installed in your system, or you have chosen to manually specify an adapter. Currently, Setup will load support for the following mass storage devices(s):

<none>

- \* To specify additional SCSI adapters, CD-ROM drives, or special disk controllers for use with Windows, including those for which you have a device support disk from a mass storage device manufacturer, press **S**.
- \* If you do not have any device support disks from a mass storage device manufacturer, or do not want to specify additional mass storage devices for use with Windows, press **ENTER**.

**Figure 35 Specifying a driver for your HBA**

4. Insert the EMC-approved HBA Drivers diskette or EFI RAMDisk if applicable for your OS. Then press **Enter** to continue.

This displays a screen similar to [Figure 36 on page 55](#).

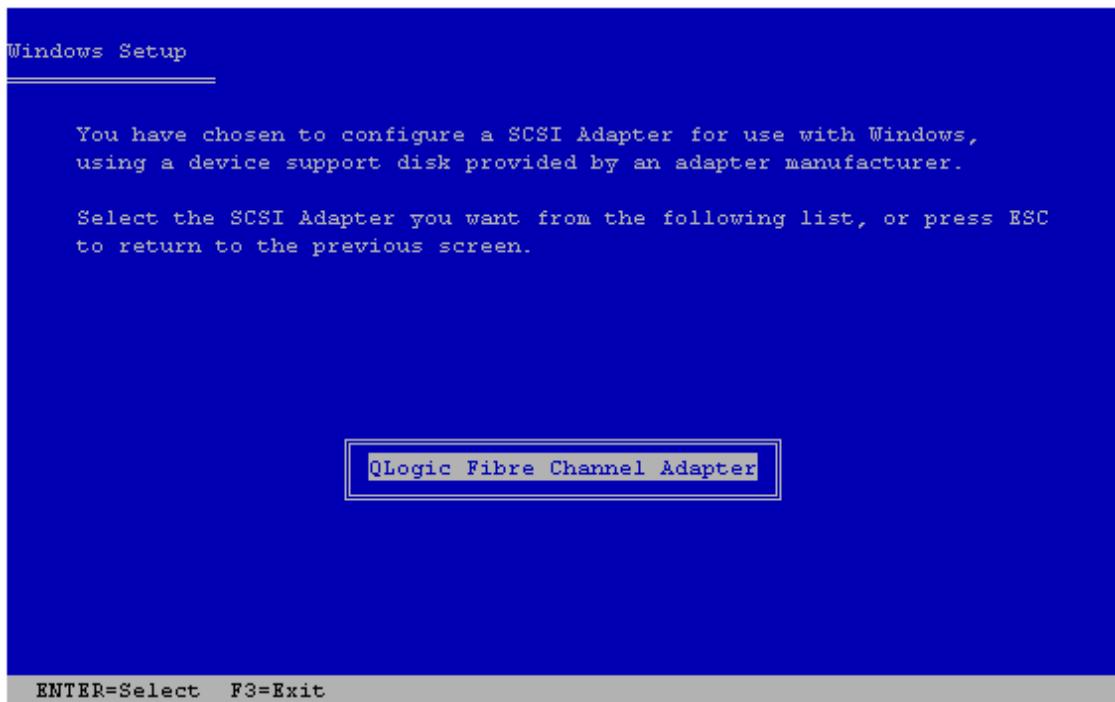


Figure 36 HBA selection screen

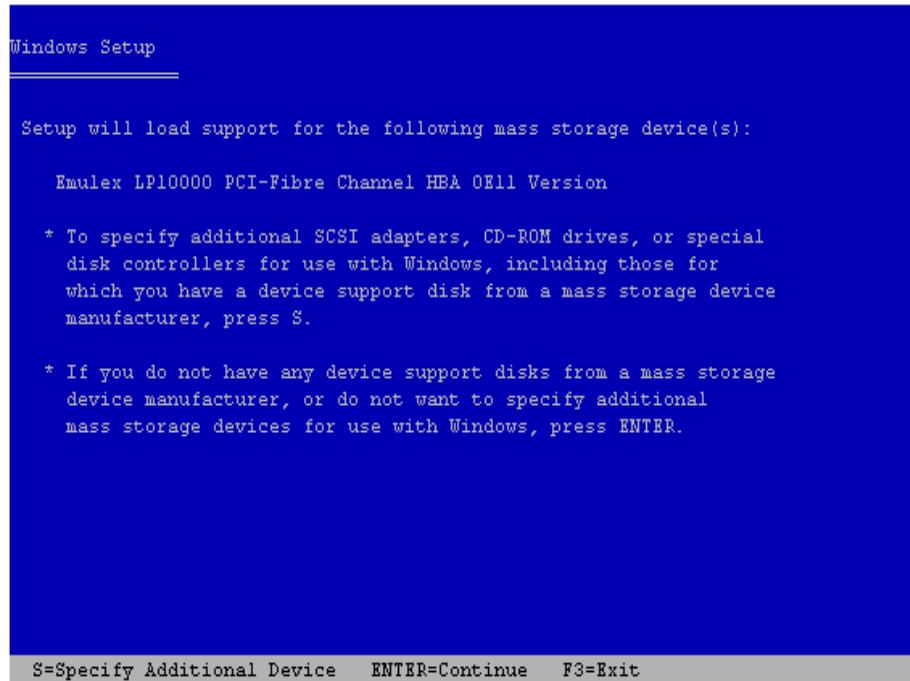
5. Select the appropriate boot HBA and press **Enter**. (You may have to scroll down to find the appropriate driver.)

---

**Note:** Depending on the version of Windows, you may receive an error message that the default driver is newer than the provided one. Ignore this message.

---

Setup continues to load files, and a **Windows Setup** screen appears.



**Figure 37      Windows setup screen**

6. Press **Enter** to begin the setup procedure.

---

**Note:** If you are installing Windows on a newly created LUN, you may receive a message that your boot disk is new or erased. Press **C** to continue.

---

A Windows Licensing Agreement appears.

7. Read the license agreement. (Press **Pg Dn** as necessary to scroll through the text.) To accept the agreement, press **F8**.

Setup inspects your computer's hardware configuration. The setup screen displays disk partition information (if your system already contains partitions), or lets you create a new partition. (Refer to [Figure 38 on page 57](#).)

**Note:** The Windows 2000 boot LUN cannot exceed 7.8 GB unless INT-13 extensions are enabled in the HBA BIOS. (Refer to Microsoft Knowledge Base article Q240672.)

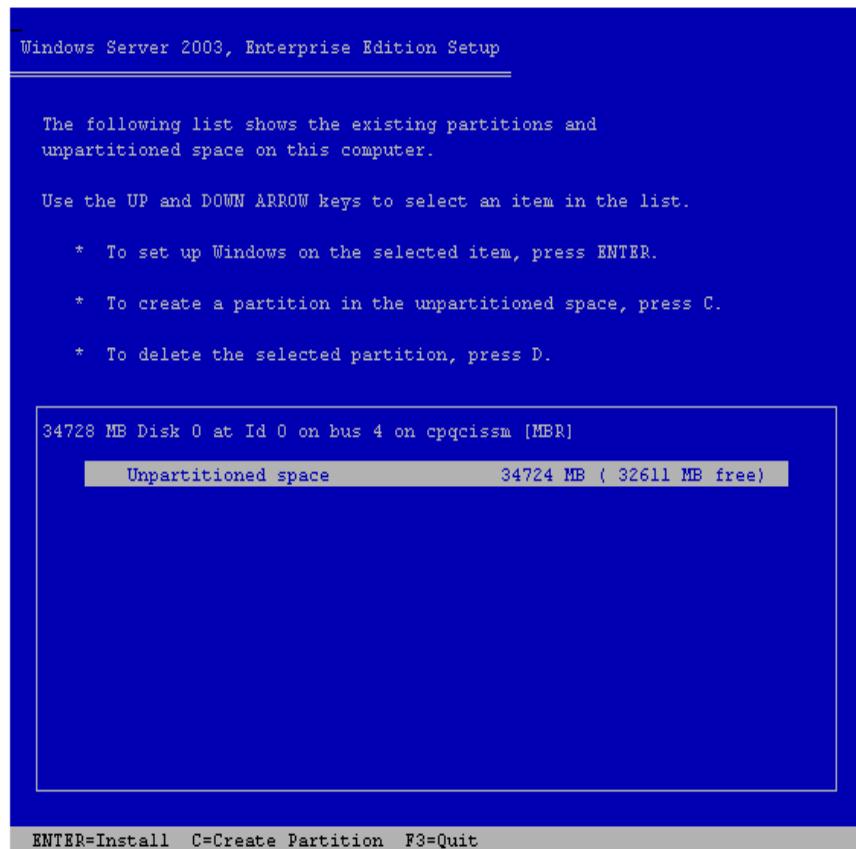


Figure 38 Existing partitions

8. If you are installing an operating system for the first time, highlight **Unpartitioned Space** on the HBA. Then:
  - Press **Enter** to use the entire disk as one partition  
or
  - Press **C** to create a custom partition, and then specify the partition size

If the new disk is displayed as **Unformatted** or **Damaged** you must delete the partition before continuing. To do this, press **D**, and follow the onscreen delete instructions. After you delete the partition, the disk will then appear as **Unpartitioned Space**.

If you are reinstalling Windows, the setup software prompts you to overwrite or upgrade:

  - To overwrite, press **Esc** and follow instructions.
  - To upgrade, press **Enter**.
  - To create a new hard-disk partition, you must first delete the existing partition, and then create a new one. To do so, select the partition you want to delete, press **D**, and then follow the onscreen instructions to complete the deletion of the partition. Once the system deletes the partition, you can press **C** to create a new one.)
9. The setup software prompts you to specify the file system format for the partition. Select **NTFS file system** format (which is suitable for most sites) and press **Enter**, unless you have other specific requirements.

---

**Note:** For background information on the choice of the NTFS file system, refer to Microsoft Knowledge Base Article 184006.

---

Setup formats the partition, copies the Windows system files to the partition, and starts rebooting the server.

10. When prompted, remove the diskette and CD-ROM.
11. If your system prompts you to press any key to boot from CD-ROM, do not press a key. Instead, allow the system to boot from the array (if external) or the local disk (if internal). After booting, the system continues installation, displays the Windows banner, and begins autodetection of mass-storage devices and adapters.

12. Follow the onscreen instructions to complete the installation. When the **Completing the Windows Setup Wizard** screen appears, click **Finish**.
13. Install the latest EMC-approved Windows Service Pack and/or OS patches or updates. Follow the procedures in the Microsoft documentation that accompanies the updates.

---

## Windows 2008 internal/external boot disk installation

This section is a step-by-step procedure for installing a Windows operating system to either an internal or external boot device.

After you have your HBA(s) installed in your server, and configured for external boot if necessary, the next step is to install the Windows operating system. If you intend to boot to an external device, refer to [“Booting from the external storage array” on page 24](#) for setting the boot BIOS for external boot and selecting the xternal boot LUN.

---

**Note:** If you intend to boot to an external disk, present only the LUN from which you intend to boot. All additional LUNs can be added after the installation. This will eliminate confusion on selecting the correct partition for installation and eliminates any problems that the operating system could encounter on reboot during the installation. Also confirm there is only **one** path to the storage array. Having more than one path can cause the operating system to fail during the installation.

---

To install Windows, you need the following materials:

- ◆ A Windows DVD-ROM for the Windows 2008 you wish to install
- ◆ An EMC-approved HBA driver jump-drive (USB) for Windows

**To install Windows:**

1. Insert a bootable Windows DVD-ROM into the drive and reboot the system. If your system has a bootable disk already configured from a previous installation, the software will prompt you to press any key to boot from DVD-ROM.
2. If you are installing Windows to boot from an external array disk, you will need to supply setup with the HBA driver in a USB jump-drive and insert it in your server prior to the Windows installation.

The **Windows Boot Manager** screen displays (Figure 39).

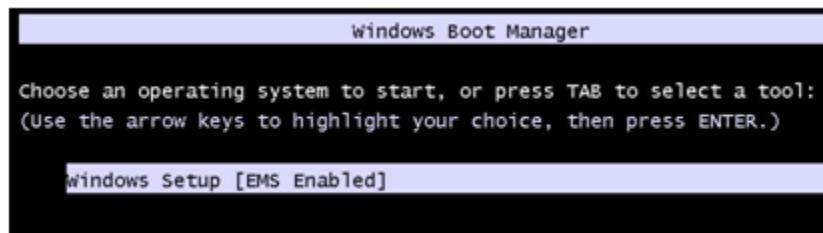


Figure 39 Windows Boot Manager

3. Press **Enter** to continue the installation.

The **Windows Setup** screen displays (Figure 40).

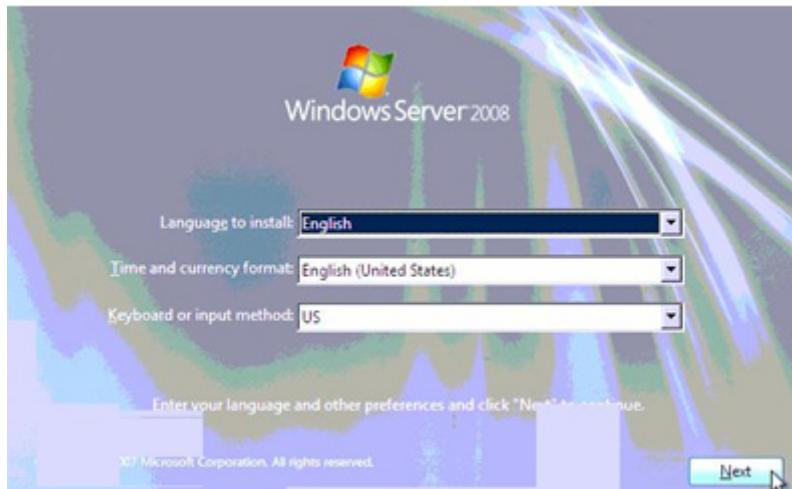


Figure 40 Windows Setup screen

4. Click **Next** to continue to the **Windows Install** screen (Figure 41).



Figure 41 Windows Install screen

5. Click **Install now** to continue to the **Windows operating system selection** screen (Figure 42).

Select the operating system you want to install.

Operating System	Architecture	Date Modified
Windows Server 2008 Standard (Full Installation)	X86	1/19/2008
<b>Windows Server 2008 Enterprise (Full Installation)</b>	<b>X86</b>	<b>1/19/2008</b>
Windows Server 2008 Datacenter (Full Installation)	X86	1/19/2008
Windows Server 2008 Standard (Server Core Installation)	X86	1/19/2008
Windows Server 2008 Enterprise (Server Core Installation)	X86	1/19/2008
Windows Server 2008 Datacenter (Server Core Installation)	X86	1/19/2008

Description:

This option installs the complete installation of Windows Server. This installation includes the entire user interface, and it supports all of the server roles.



Figure 42 Windows operating system selection screen

6. Choose your operating system type and click **Next** to continue to the **Microsoft Software License Terms** screen (Figure 43).



**Figure 43 Microsoft Software License Terms screen**

7. Check the **I accept the license terms** checkbox and click **Next** to continue to the **Windows setup** screen (Figure 44 on page 63).

Which type of installation do you want?

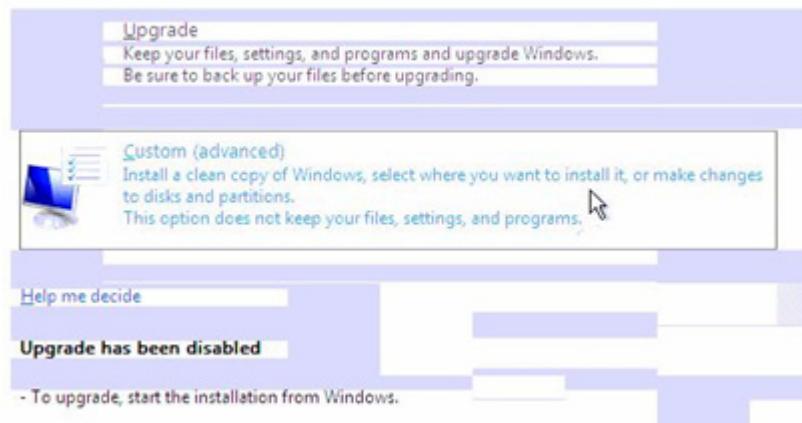


Figure 44 Windows setup screen

8. Click **Custom (advance)** if you want to install a clean copy of Windows.

The **Load driver** screen displays (Figure 45).

Where do you want to install Windows?

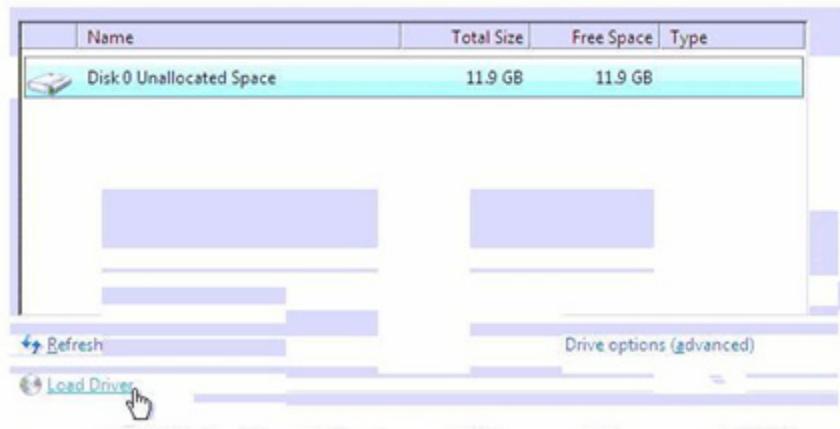
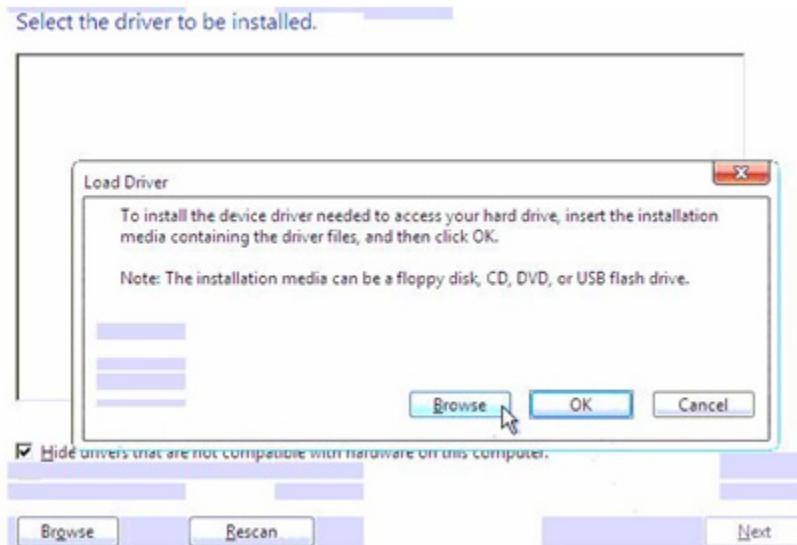


Figure 45 Load driver screen

9. Select **Load Driver** ([Figure 45 on page 63](#)) if booting from the external device and then click **Next** to continue.

The **Loading driver** screen displays ([Figure 46](#)).



**Figure 46** Loading driver screen

10. Click **Browse** to load your HBA driver.

The **Browse for Folder** screen displays (Figure 47).

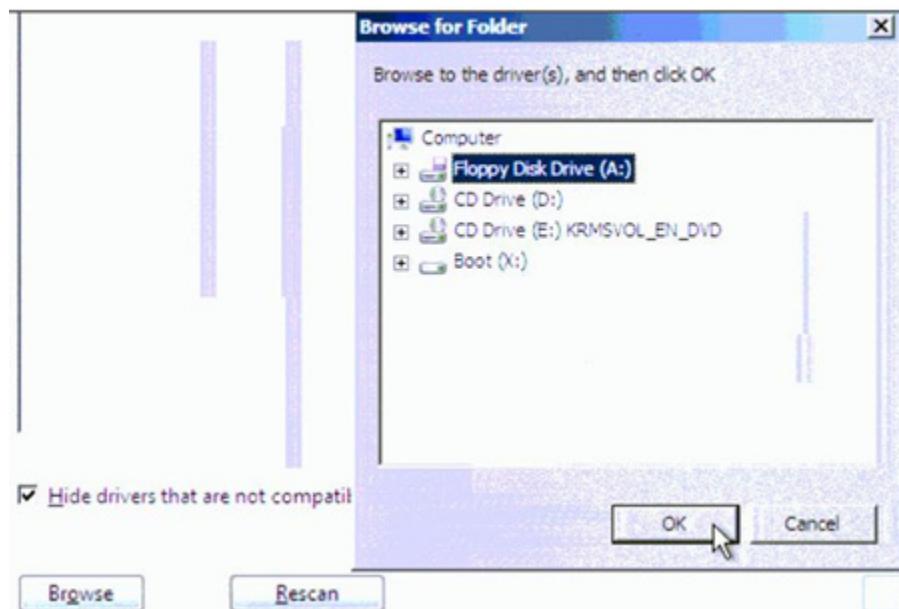


Figure 47      **Browse for Folder** screen

---

**Note:** You would see your USB jump-drive rather than the Floppy Drive A as shown in Figure 47.

---

11. Select your USB jump-drive (Figure 48).

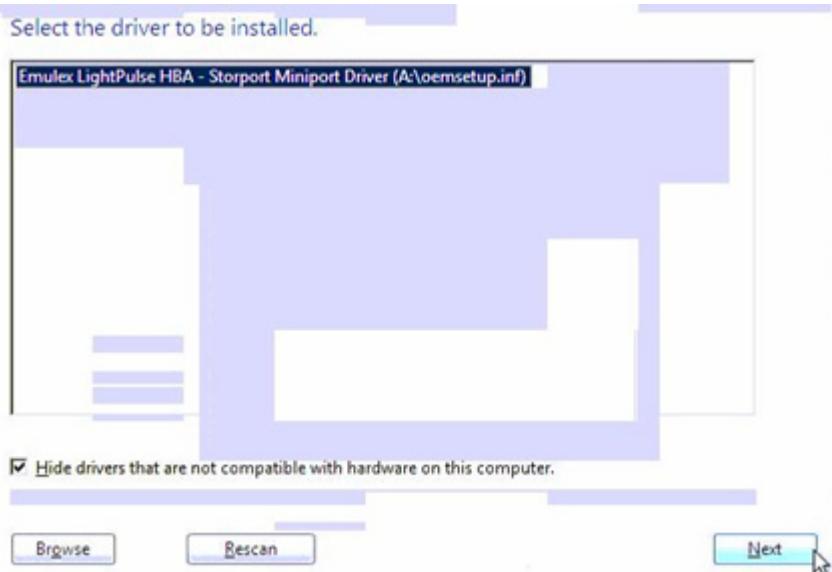


Figure 48 Specifying a driver for your HBA

12. Click **Next** to load your HBA driver.

You will be asked where you want to install Windows (Figure 49).

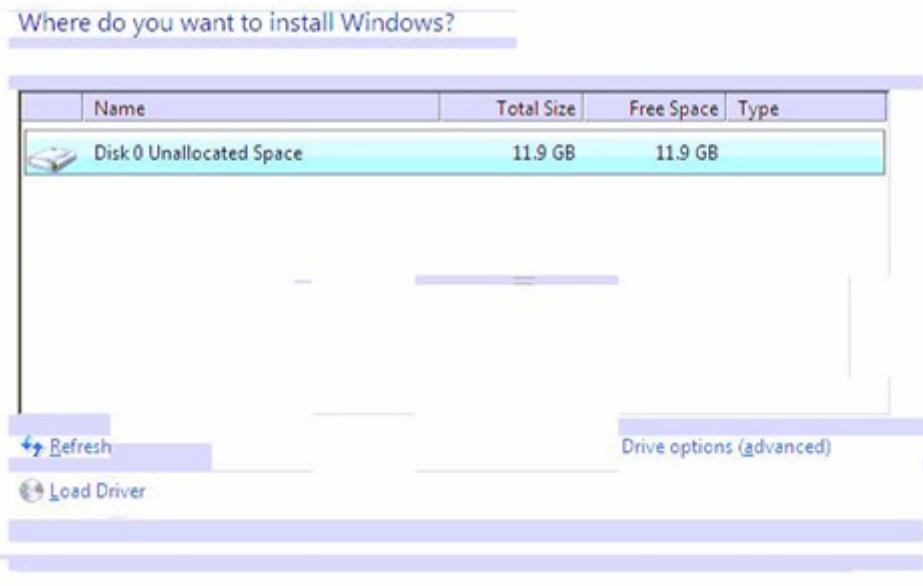


Figure 49 Windows installation prompt screen

**Note:** Select **Drive Options (advanced)** to format your file system.

After the HBA driver is loaded, the **Install Windows** screen displays (Figure 50).

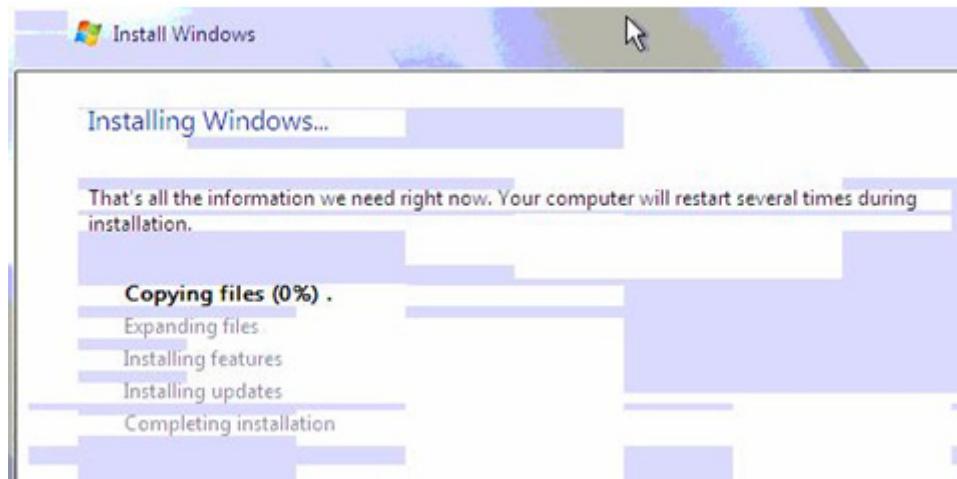


Figure 50    **Install Windows** screen

13. Click **Next** to begin the Windows installation.

Setup will copy the Windows system files to the partition and start rebooting the server.

14. Do *not* press a key if your system prompts you to "press any key to boot from DVD-ROM." Instead, allow the system to boot from the array (if external) or the local disk (if internal). After booting, the system continues installation, displays the Windows banner, and begins auto detection of mass-storage devices and adapters.

15. Follow the on-screen instructions to complete the installation.

## Installing HBA driver and software utilities

To use EMC storage array disks with a Windows 2000, 2003, or 2008 host, you need a Fibre Channel host adapter driver. The driver and related utilities must be installed and configured before Windows can access the EMC disks. This driver can be installed using the QLogic SANsurfer Install Wizard for Windows.

For Windows 2003, EMC supports both the STORPort driver class and the SCSIPort driver class. Windows 2000 uses only the SCSIPort driver class. Windows 2008 uses only the STORPort driver class.

Three sections are outlined on the following pages to help with installation and configuration of your HBA drivers and associated utilities:

- ◆ “[Pre-installation guidelines](#)”, next
- ◆ “[Driver installation/upgrade](#)” on page 70
- ◆ “[Post-installation procedures](#)” on page 76

### Pre-installation guidelines

#### Windows 2003 STORPort updates

Currently, the shipping version of Windows 2003 requires post-RTM hot fixes to resolve some known issues. For all Windows 2003 STORPort installations, you should obtain the current Microsoft QFE hotfix listed in the with the HBA driver revisions.



#### IMPORTANT

**Install this patch and reboot before installing the HBA driver.**

EMC recommends that users planning to upgrade to Service Pack 1 or later for Windows 2003 should upgrade their HBA drivers to the latest supported version prior to installing the service pack.

#### Obtaining the QLogic SANsurfer Install Wizard for Windows

The SANsurfer Install Wizard for Windows is available on CD-ROM or downloaded from the QLogic website. To download from the website:

1. If downloading from the QLogic website, first create a directory that will be used to save the SANsurfer Install Wizard for Windows file.
2. Go to <http://www.qlogic.com>.

3. Select **Downloads** on the left side of the page.
4. Select **EMC** under OEM models.
5. Select the link containing your EMC storage.
6. Select the HBA you installed in your system and download the SANsurfer Install Wizard for Windows.

### Driver installation/upgrade

1. Install the SANsurfer Install Wizard for Windows Kit CD-ROM to start the SANsurfer HBA Install Wizard. If you downloaded the kit to your hard drive locate and double-click the file. The following wizard will appear.

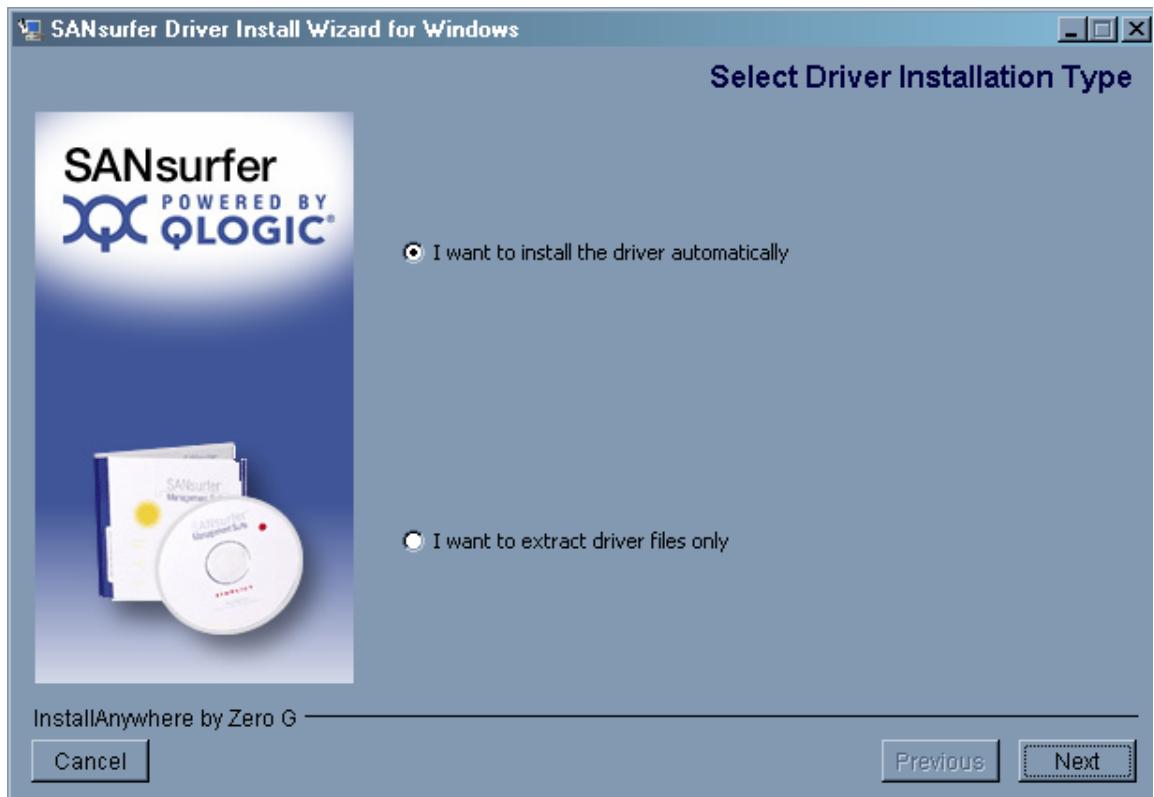
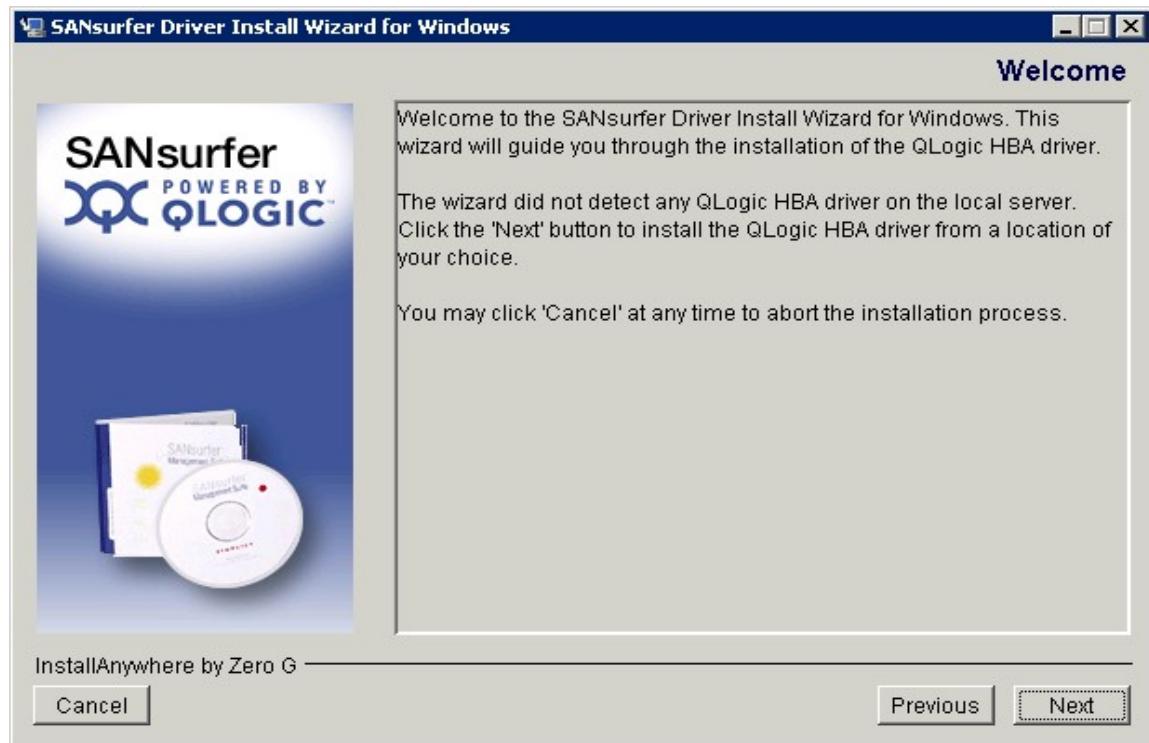


Figure 51 SANsurfer driver installation type

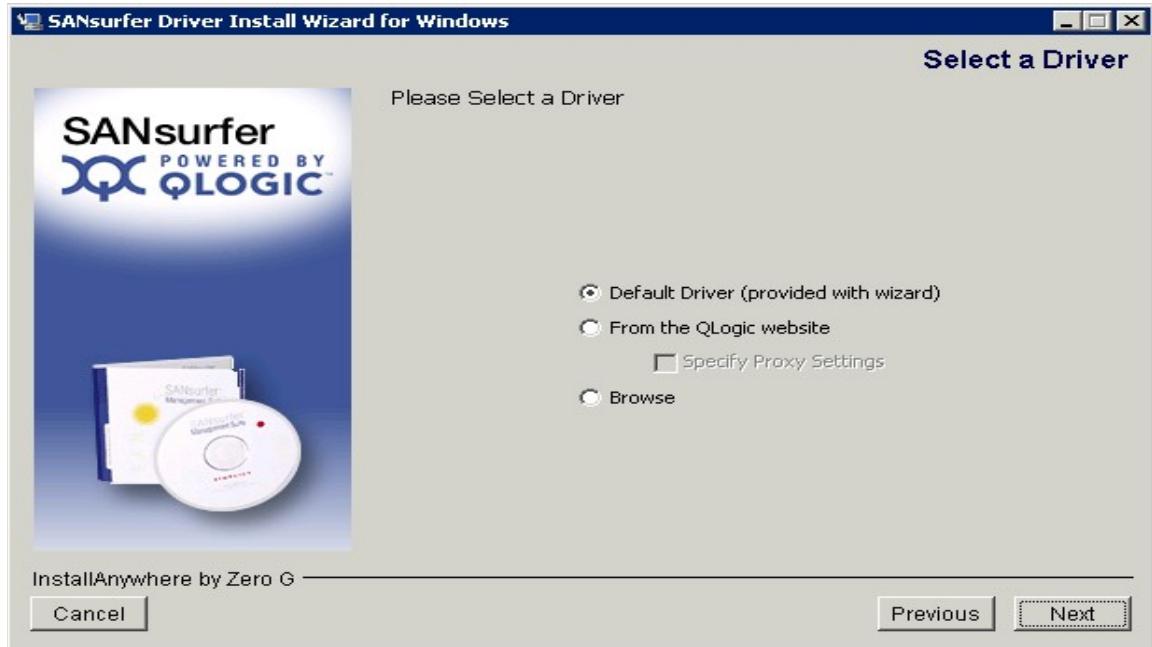
2. Select **I want to install the driver automatically**.

**Note:** If you are upgrading your HBA driver, you will be taken to the HBA Configuration Update screen shown in [Figure 57 on page 76](#). At this point, click the Update Driver button. You will be taken to the driver selection screen shown in [Figure 53 on page 72](#). Select the driver you wish to install, and proceed with the procedure at Step 4 on [page 73](#).



**Figure 52 SANsurfer Driver Install Wizard for Windows welcome**

3. Click **Next** to start the HBA driver installation.



**Figure 53 SANsurfer driver selection**

This window presents three choices:

- Default Driver

This is the default selection. This selection will use the driver located on the CD-ROM or the SANsurfer Install Wizard for Windows file. The latest driver versions are listed in the . Use this option if you downloaded the kit from the QLogic website.

- From the QLogic website

The selection will automatically search the QLogic website for the latest driver. An Internet connection is required. Use this selection if you are upgrading your HBA drivers to a newer version.

- Browse

Use this option if you previously downloaded the driver file and stored it on your hard drive.

4. Click **Next** to continue. A message similar to the following will appear:

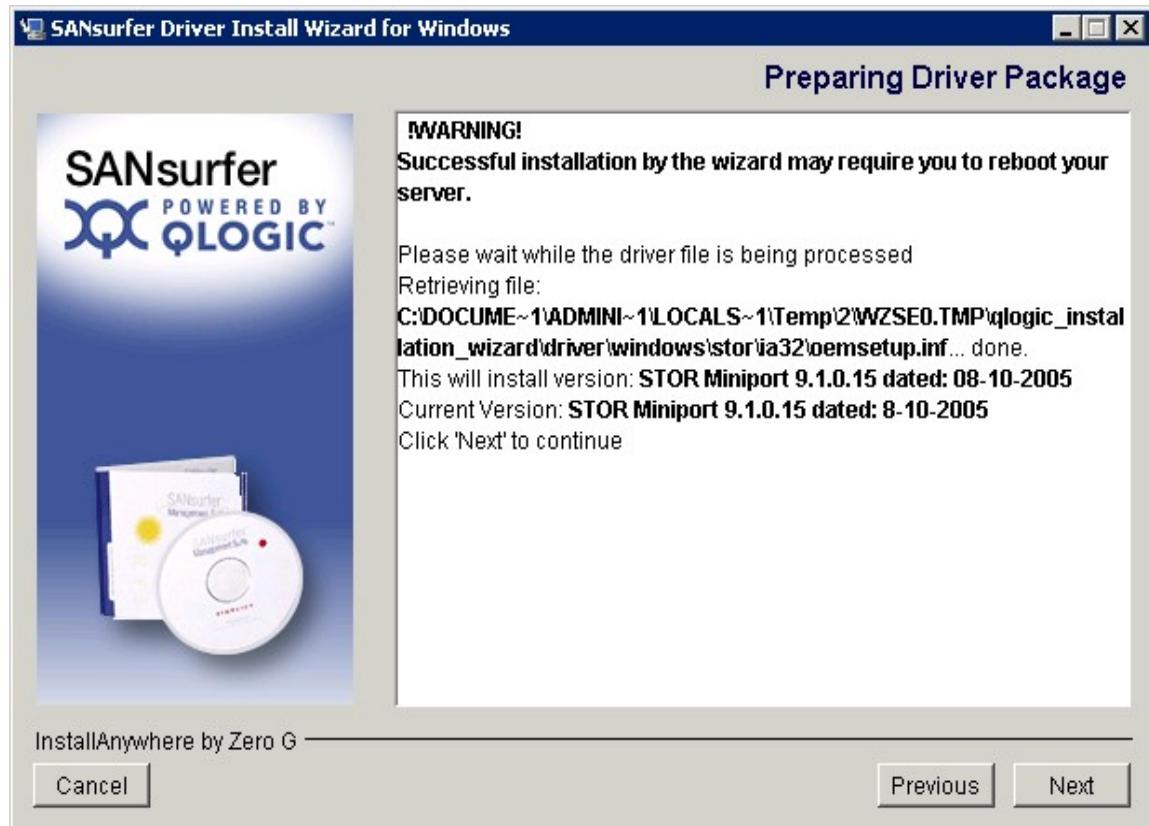
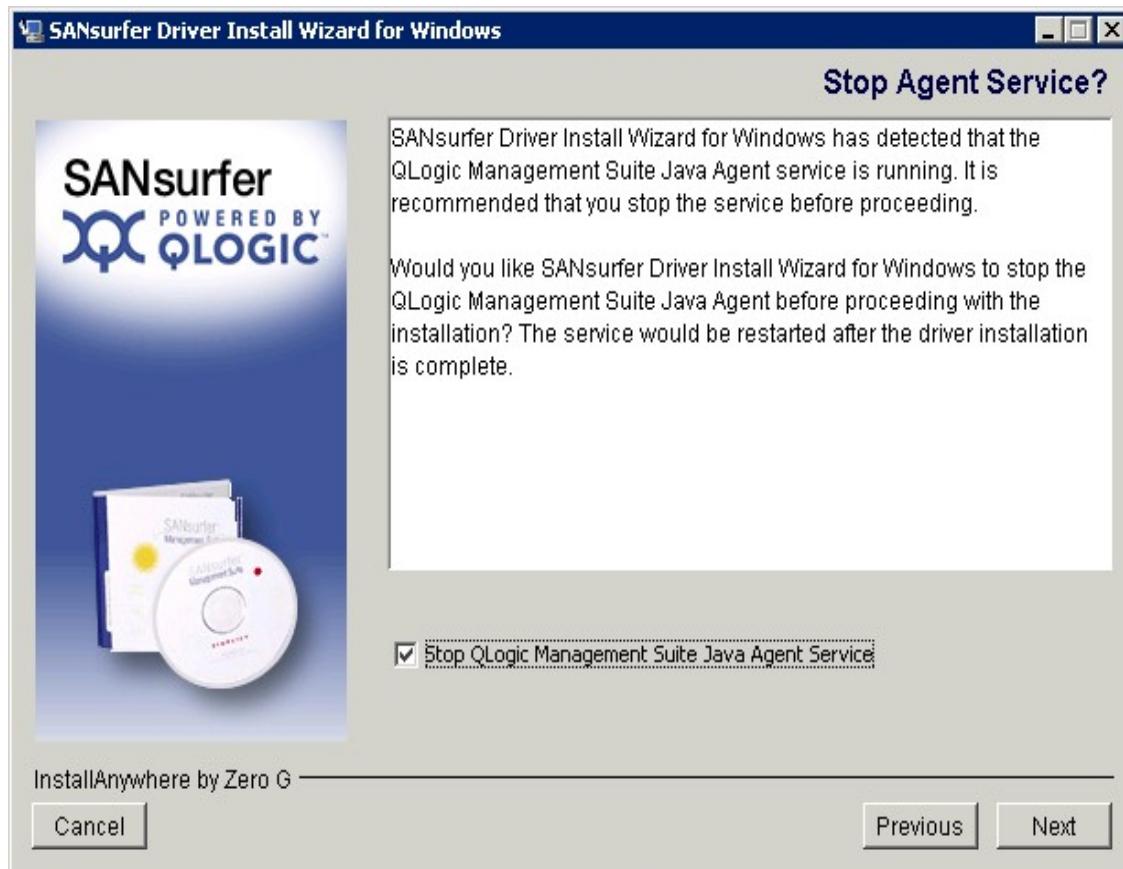


Figure 54 SANsurfer installation with version number

5. The version of driver to be installed will be listed. Follow the instructions and click **Next**.



**Figure 55 SANsurfer Java agent service message**

6. If this is *not* a new installation, the message in [Figure 55](#) may appear. Check the **Stop QLogic Management Suite Java Agent Service** checkbox and click **Next**.

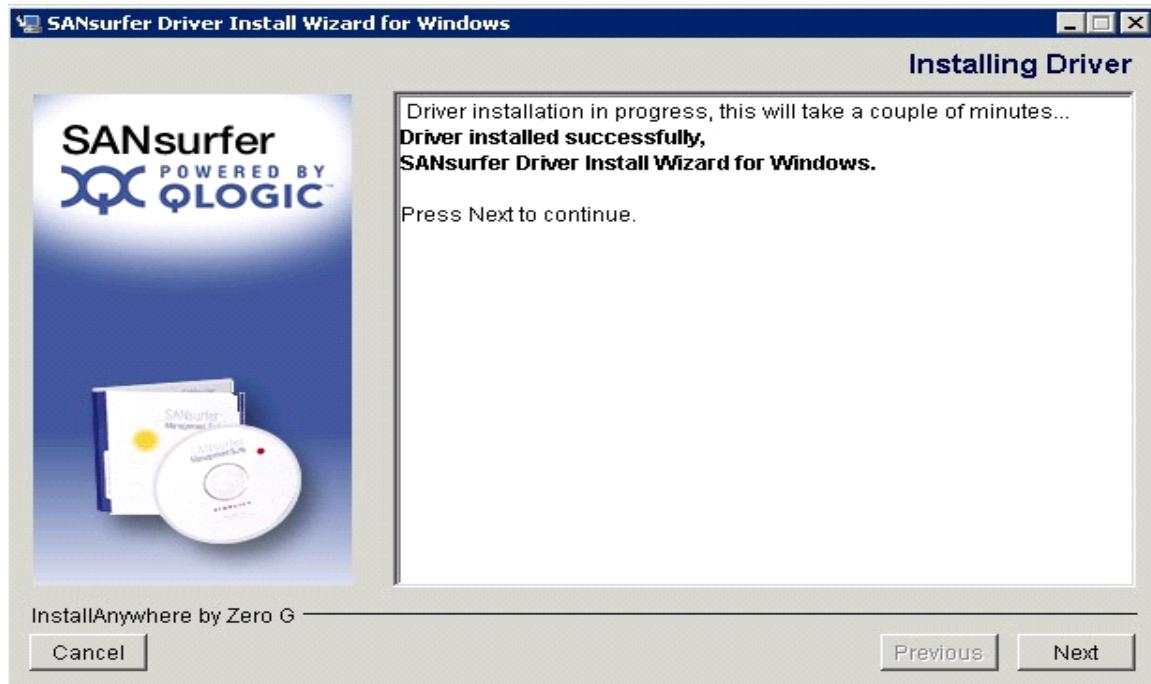


Figure 56 SANsurfer driver installation completed successfully

7. A **Driver installed successfully** message will appear when the driver is installed. Click **Next** to continue.

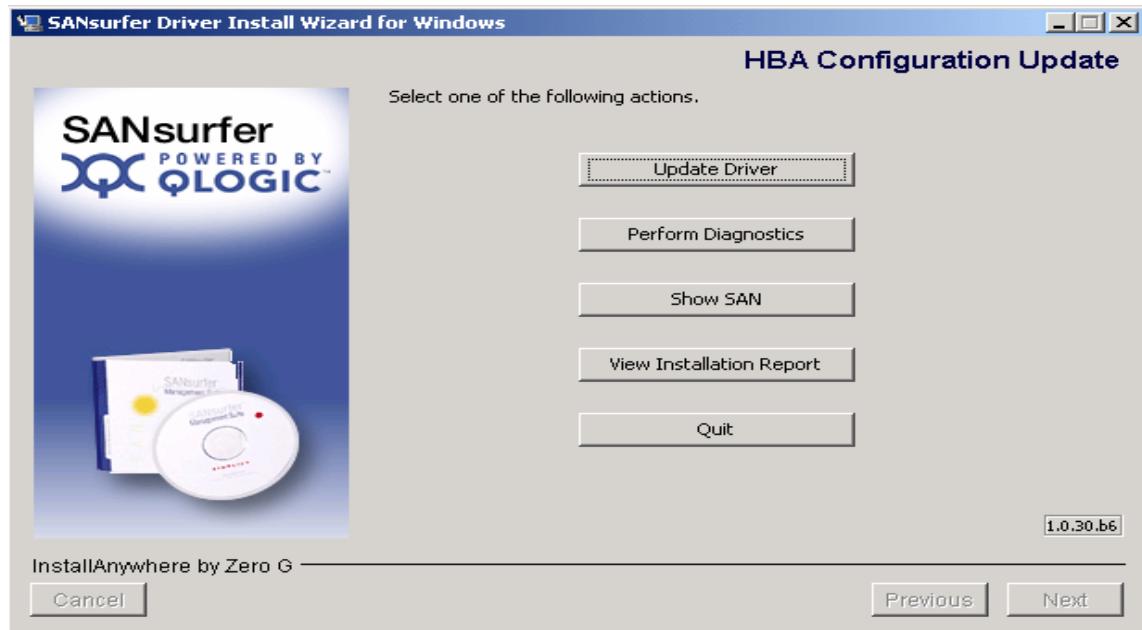


Figure 57 SANsurfer driver installation complete

The **HBA Configuration Update** screen will appear after the driver installation is complete. From here, you may perform diagnostic procedures or other post-installation tasks. If you are finished with your HBA update, click **Quit**.

## Post-installation procedures

### Diagnostics

1. From the **HBA Configuration Update** screen, click **Perform Diagnostics** (refer to [Figure 57](#)). The **SANsurferHBA Install Wizard** window will appear, as shown in [Figure 58 on page 77](#).

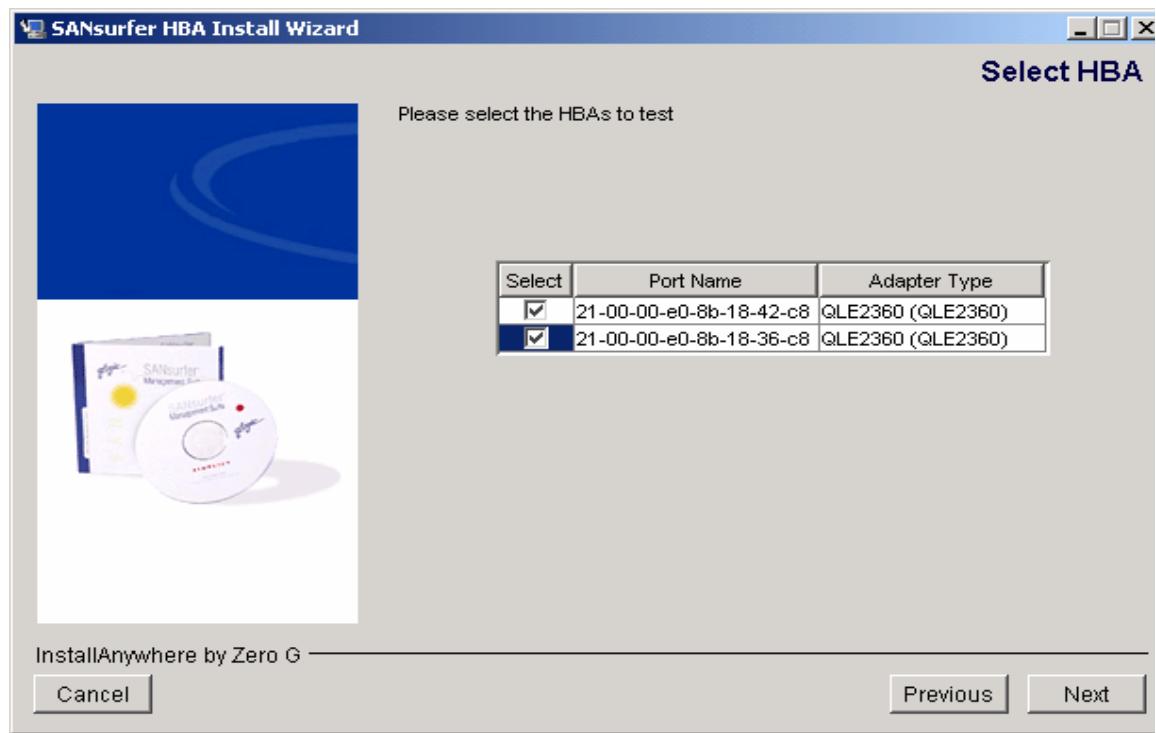
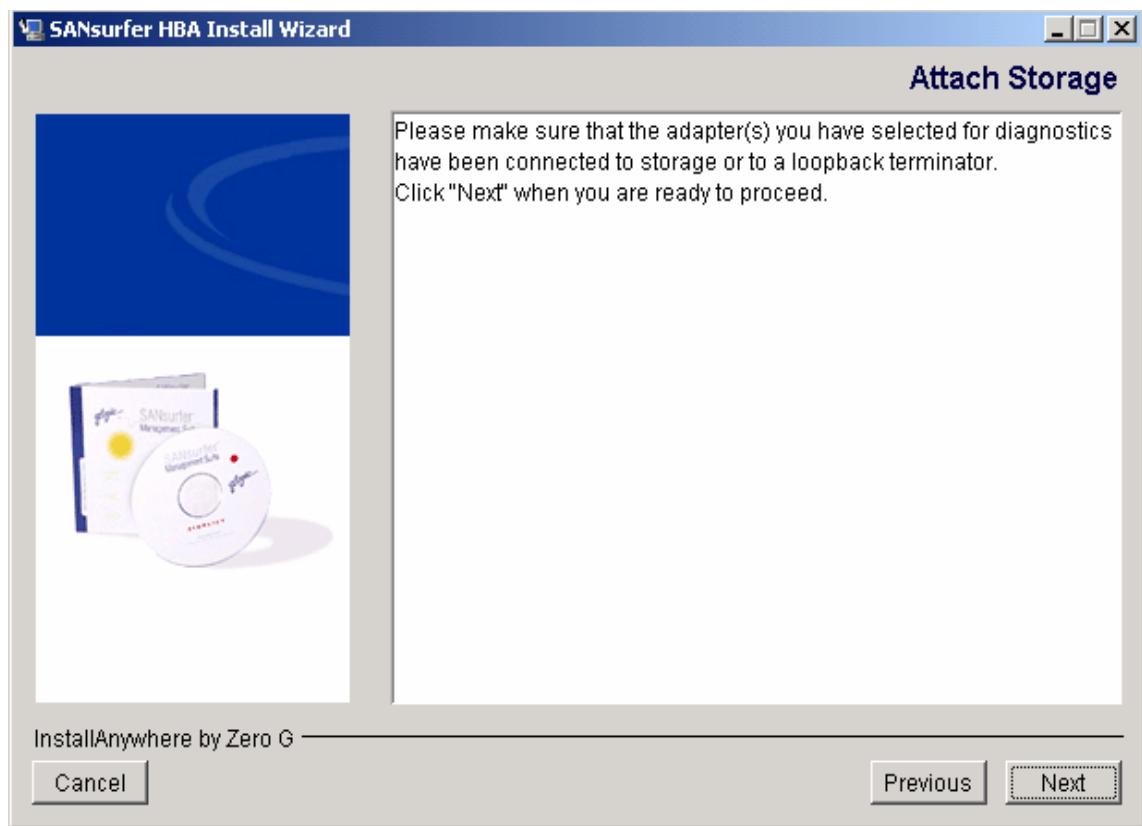


Figure 58 SANsurfer HBA install wizard

2. Select the HBAs to be tested and select **Next**.



**Figure 59 SANsurfer install wizard attach storage**

3. Ensure that the HBAs you selected for diagnostics are connected to storage or to a loopback terminator. Click **Next** to run the test.

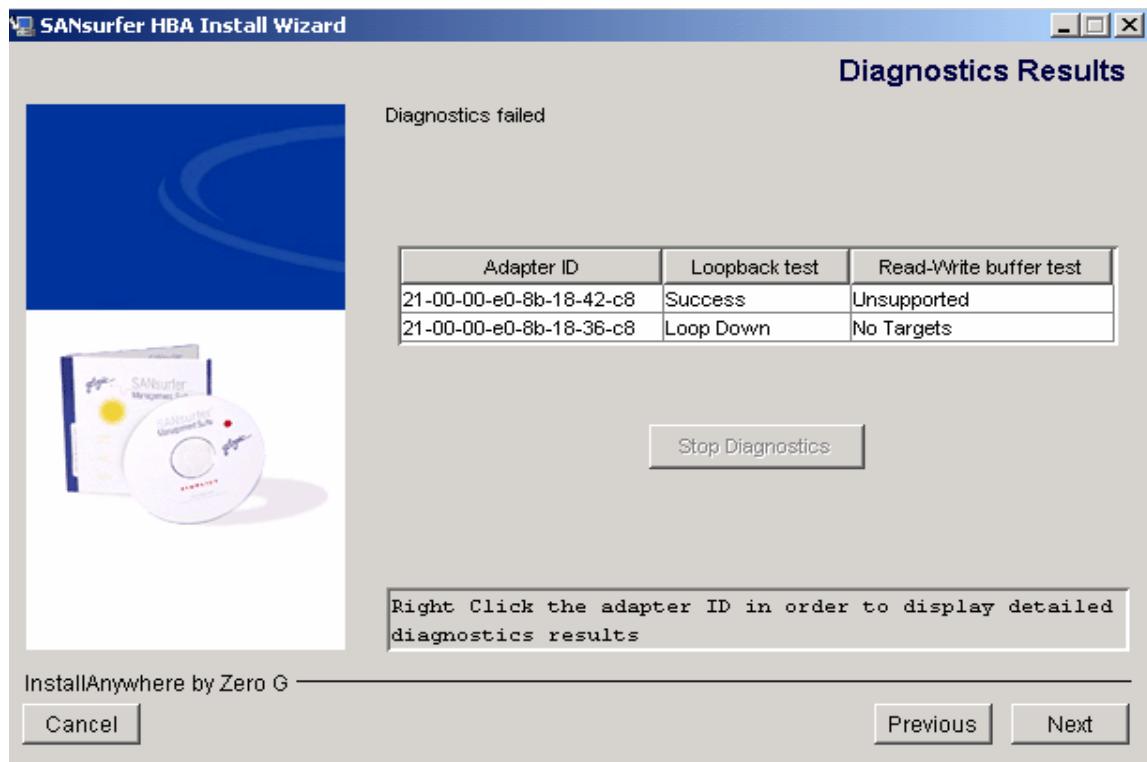
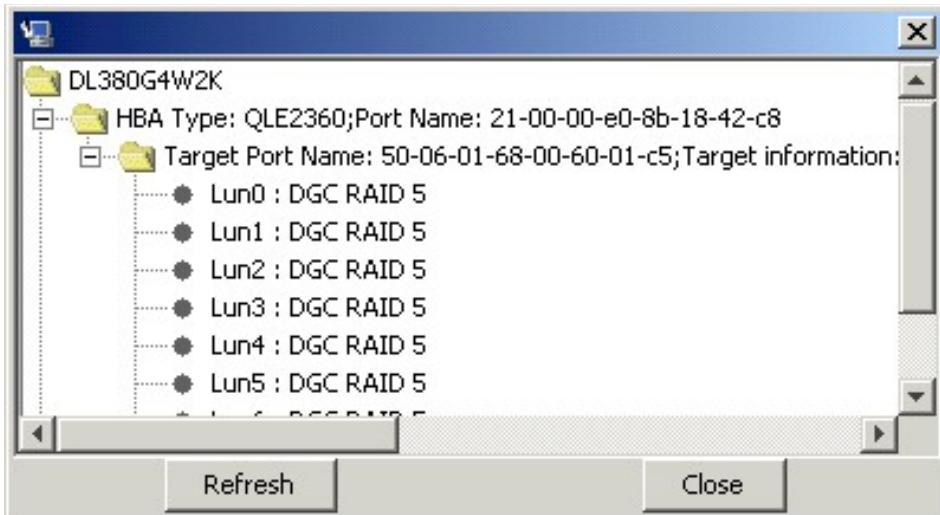


Figure 60 SANsurfer HBA installation diagnostics results

4. The next window will display the diagnostics results. More information on this tool is available at the QLogic website [www.qlogic.com](http://www.qlogic.com). Select **Next** to return to the main menu.

## Show SAN

[Figure 61](#) shows the SAN tree.



**Figure 61 Show SAN tree**

The **Show SAN** feature is useful for verifying connectivity to the storage array.

## Verifying connectivity to the storage array

You can verify connectivity either with

- ◆ QLogic SANSurfer, discussed next, or
- ◆ Server Manager, [page 83](#)

### Verifying connectivity through QLogic SANSurfer

To verify connectivity through QLogic SANSurfer:

On a Windows Server start the SANsurfer application, which includes the SANsurfer FC HBA Manager GUI. When complete, the SANsurfer application GUI displays. (Refer to the **SANsurfer FC HBA Manager** main window, as shown in [Figure 64 on page 83](#)).

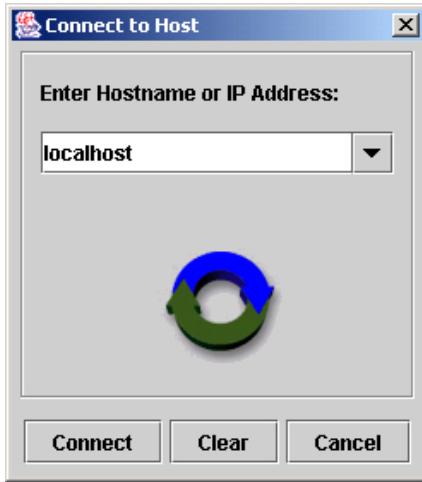
1. Double-click the SANsurfer icon, as shown in [Figure 62](#), on your desktop (if the icon was created during installation).



Figure 62 SANsurfer icon

2. Click **Connect** on the **SANsurfer FC HBA Manager** main window toolbar.
3. On the **SANsurfer FC HBA Manager** main window **Host** menu, click **Connect**.
4. Right-click the **HBA tree**. From the shortcut menu, click **Connect**.
5. Press **HOME**.

The **Connect to Host** dialog box displays, as shown in [Figure 63 on page 82](#).



**Figure 63** Connect to the host

6. In the **Enter Hostname or IP Address** field, perform one of the following:
  - Select localhost to connect to the machine on which you are using the SANsurfer FC HBA Manager GUI.  
or
  - Type or select a remote machine. You can use the hostname or the machine's IP address.
7. Do one of the following:
  - Click **Connect** to initiate the connection. If successful, the host and its HBAs display in the HBA tree. If you entered a new remote host and the connection was successful, its name is also added to the **Enter hostname or IP address** box drop-down list.
  - Click **Cancel** to abort the connection process and return to the **SANsurfer FC HBA Manager** main window, as shown in [Figure 64 on page 83](#).
  - Click **Clear** to delete all machines on the list except local host. (The local machine cannot be deleted.)

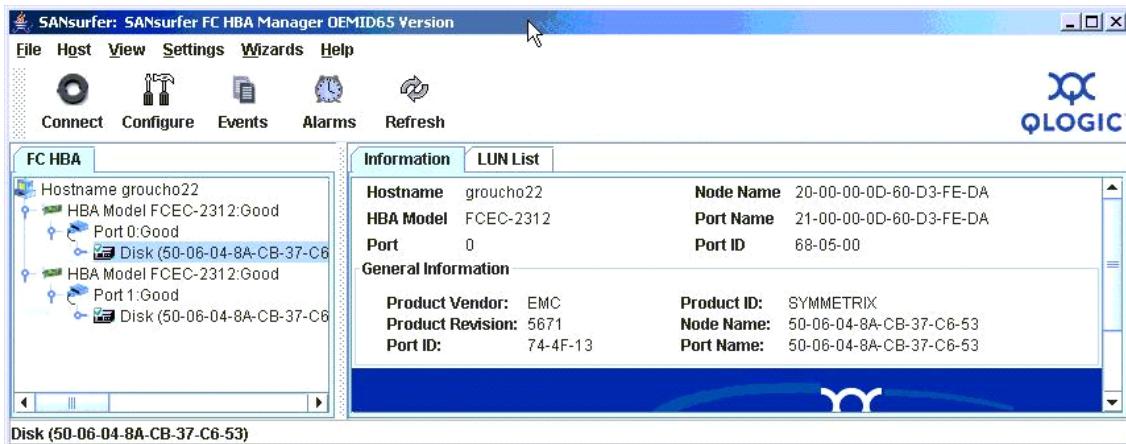


Figure 64 SANsurfer, SANsurfer FC HBA manager

## Verifying connectivity using the Server Manager

To verify an HBA is connected to a storage device using ServerManager:

**Note:** The display assumes the driver and cable were properly installed. For more detail, refer to [“Installing HBA driver and software utilities” on page 69](#).

1. Right-click **My Computer** on the desktop and select **Manage** to display the **Server Manager** dialog box (Figure 65).

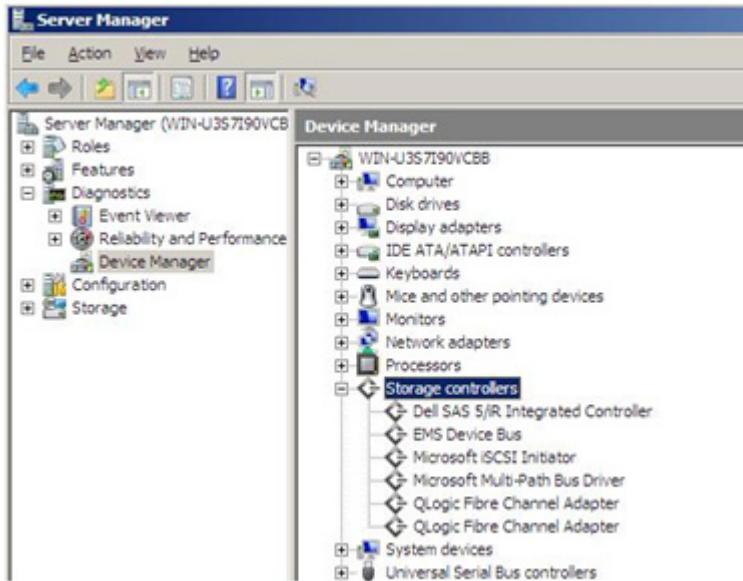


Figure 65 Server Manager window: Storage controllers pane

2. Select **Diagnostics > Device Manager** and click on **Storage controllers** icon (Figure 65) to verify that HBAs are detected and installed.

3. Click **Disk Drives** to list all target LUNS attached to the entire system (Figure 66).

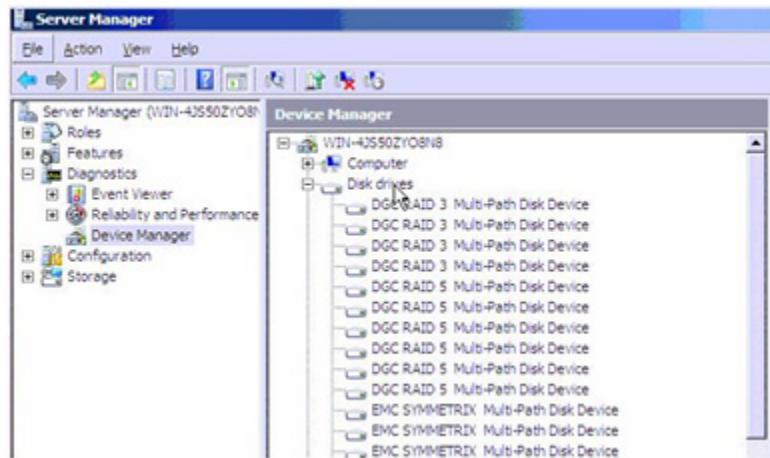


Figure 66 Server Manager window: Disk drives pane

## Installing additional Navisphere Host Agent software

The Navisphere Host Agent should be used to automatically register host connections with the array. PowerPath® and ATF require different registration types and the Navisphere Host Agent is the preferred method over manual registrations.

You should install the Navisphere Host Agent software to ensure the HBA connections are all registered correctly. For instructions on how to perform this operation refer to the EMC ControlCenter® Navisphere Host Agent software documentation for your array type.

After the host agent has started and registered the new HBA paths, you should refresh the host connections in the storage group to ensure all available paths are assigned. To do this, you have two options, depending on whether you want to disrupt the connectivity of the host, as described next.

### **Option 1: Without disrupting host connectivity (more complex procedure using Navisphere CLI):**

**Note:** You must have Navisphere CLI installed. Refer to product notes for complete usage instructions.

1. Using a command prompt, browse to the Navisphere CLI directory (typically C:\Program Files\EMC\Navisphere CLI>).
2. Enter command **navicli -h <sp\_IP> storagegroup -connecthost -host <hostname> -gname <storagegroupname>**  
where *<sp\_IP>* is the IP address of either array SP; *<hostname>* is the hostname of the host connection to update and *<storagegroupname>* is the name of the storage group of the host connection to update.
3. When prompted, verify the *<hostname>* and *<storagegroupname>* are correct as follows:  
Connect host *<hostname>* to storage group  
*<storagegroupname>* (y/n)?"  
Enter **y** to proceed.
4. Perform a device rescan on your host, and verify the additional device paths are present.

**Option 2: With brief disruption of host connectivity (simpler procedure using Navisphere GUI):**

1. Shut down the host.
2. Remove the host from the storage group.
3. Apply the change.
4. Add the host back into the storage group.
5. Restart the host.
6. Check the array connectivity status to ensure all connections you require are active.



## Miscellaneous Planning and Procedures

---

This chapter contains information on miscellaneous procedures.

◆ Zoning and connection planning in a fabric environment .....	90
◆ Installing and configuring the QLogic QLA4010 iSCSI HBA (TOE) ..	91
◆ Booting from SAN with QLogic QLA40xx and Microsoft Initiator..	99
◆ Boot-from-SAN configuration restrictions .....	109
◆ Setting up external boot for IBM BladeCenter server HS40 (8839)..	110
◆ Manually installing the HBA driver – Advanced users.....	112
◆ QLogic advanced utilities .....	121
◆ Procedure for replacing a QLogic HBA in Stratus ftServers without rebooting .....	104
◆ Special instructions for the EMC CLARiiON CX200 series.....	128

## Zoning and connection planning in a fabric environment

In a fabric environment, the user should plan for the switch topology, target-to-hosts mapping, and the zone. Here is an overview of the recommended procedure:

1. Draw the connectivity among the hosts, switch, and storage array to verify the correct fabric configuration.
2. Configure the zone capability in the switch. If connecting to EMC Connectrix™, refer to the *Connectrix v7.01 Enterprise Storage Network System Planning Guide* for information on the zone configuration.

## Installing and configuring the QLogic QLA4010 iSCSI HBA (TOE)

The QLA4010/4010C is an iSCSI HBA that provides PCI connectivity to SCSI using the iSCSI protocol. iSCSI enables IP-based SANs, which are similar to Fibre Channel SANs. The QLA4010/4010C HBAs implement TCP/IP protocol on the HBA and relieves the host of any I/O protocol processing. This type of adapter also is called a TCP/IP Offload Engine (TOE) adapter. Off-loading frees the system to perform other tasks and optimizes system performance.

Installation of the QLA4010 iSCSI HBA is similar to installation of other QLogic HBAs. Refer to the sections for “[Installing the HBA](#)” on [page 18](#) and “[Manually installing the HBA driver – Advanced users](#)” on [page 112](#) for configurations that are booting from the EMC storage array.

## Using the QLogic iSCSI SANsurfer application to configure iSCSI devices

QLogic provides a minimal version of their SANsurfer software used to configure settings for the QLA4010 iSCSI HBA. For configurations not using Microsoft’s iSCSI Initiator, the SANsurfer iSCSI HBA Manager should be used to configure your iSCSI HBAs.

Install the SANsurfer iSCSI HBA Manager on your server using the self-extracting executable installation package (available in the EMC QLA4010 CD-ROM kit or from the QLogic website <http://www.qlogic.com>). During installation, you may choose whether to install both the GUI and agent or just the GUI. If you are installing on the system with the QLA4010 HBA(s) installed, install both the GUI and agent.

After SANsurfer is installed, it can be started from the **Start** menu, or from the desktop icon if you choose to create one.

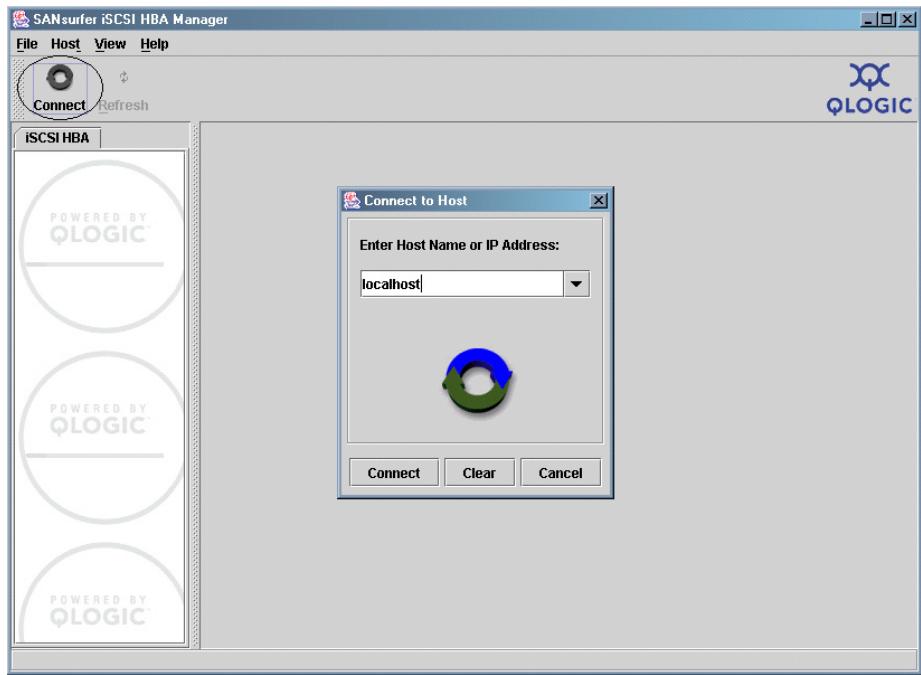


Figure 67 SANsurfer iSCSI HBA Manager, connect to host

- ◆ Click **Connect** in the upper left corner of the **SANsurfer iSCSI HBA Manager** dialog to get the **Connect to Host** dialog, as shown in [Figure 67](#).

You are asked which host to connect to. Assuming you are running the software on the server with the HBA(s) installed, keep the default name of **localhost** as the hostname and then click **Connect**.

- ◆ On the **SANsurfer iSCSI HBA Manager** dialog, the left pane displays discovered iSCSI HBAs. Click on the desired HBA in order to change its settings.

The **SANsurfer iSCSI HBA Manager** dialog defaults to the **HBA Options** tab, which is selected from the row of tabs at the top, as shown in [Figure 68 on page 93](#).

- From the **HBA Options**, you can set the iSCSI HBA parameters including IP address, subnet mask, and gateway. If an iSNS server is being used for your iSCSI configuration follow the procedure for setting up iSNS later in “[Configuring iSNS settings for QLA4010](#)”, next.

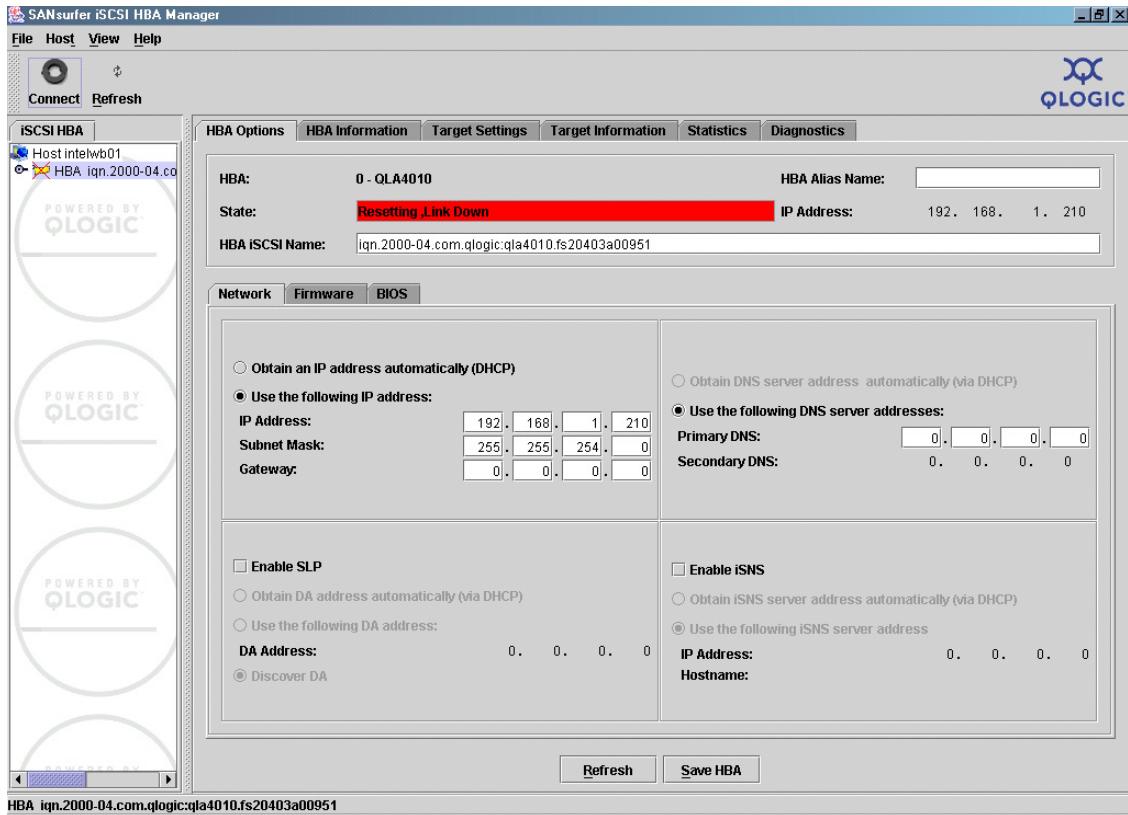


Figure 68 SANsurfer iSCSI HBA Manager, HBA Options

## Configuring iSNS settings for QLA4010

For iSNS support, the QLA4010 must be running the correct driver. Refer to the [for latest version](#).

Targets must register with the iSNS server. To register, enable the iSNS server and enter the IP address using the **SANsurfer iSCSI HBA Manager, HBA Options, Network, Enable iSNS** dialog box. Click **Save HBA** under the **Network** tab on the **SANsurfer iSCSI HBA Manager, HBA Options** tab.

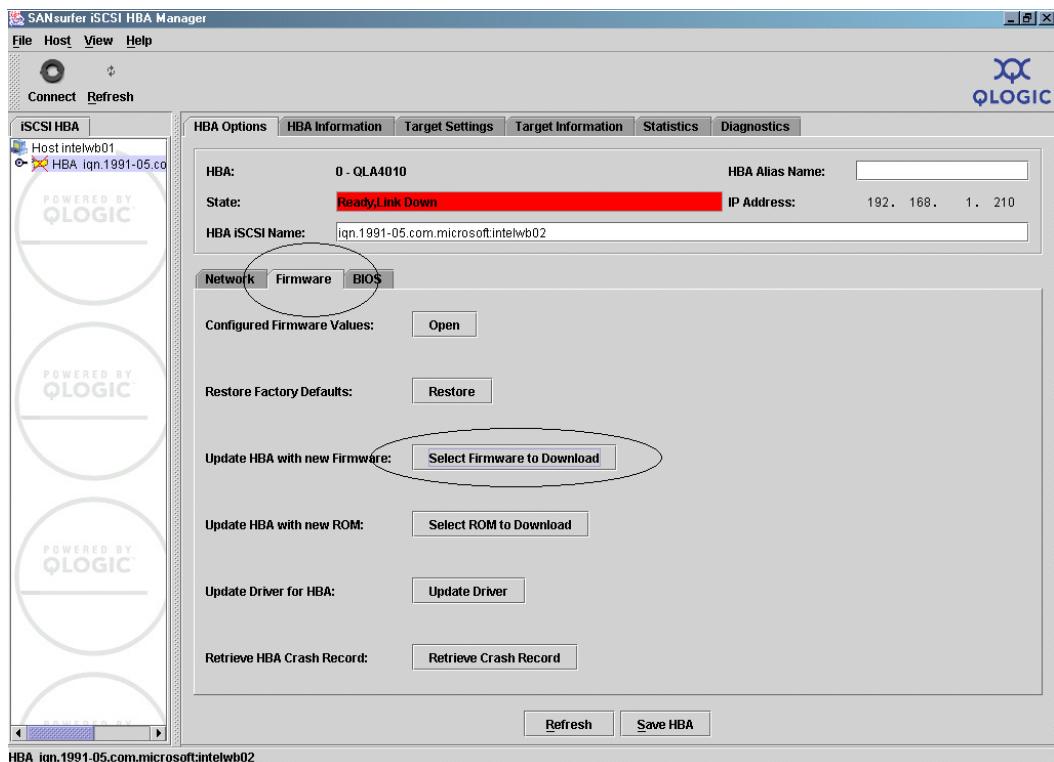
The target should be detected by SANsurfer and shown on the **SANsurfer iSCSI HBA Manager, Target Settings** tab. Click **Save Settings** to bind the targets.

If the targets are not detected, follow these steps:

1. Ping successfully to the iSNS server using the **Diagnostics** tab from the **SANsurfer iSCSI HBA Manager** dialog.
2. Go to iSNS server and iSNS server icon in the control panel or desktop.
3. Open **Discovery Domain** and confirm that both the QLA4010 and target ports are registered with the domain.

To update firmware on your iSCSI HBA:

1. Click the **Firmware** tab on the **HBA Options** dialog, as shown in [Figure 69](#).



**Figure 69** SANsurfer iSCSI HBA Manager, HBA Options, Firmware tab

2. Click **Select Firmware to Download**.

3. In the dialog that appears, as shown in [Figure 70](#), type in the path to the firmware file that you want to load to the HBA, and click **Save**.



Figure 70 Download Firmware dialog box

The firmware will be loaded to the specified HBA. After it loads, SANsurfer will reset the HBA so the new firmware will take effect.

- ◆ Boot BIOS for the iSCSI HBA can be loaded in a similar fashion. From the **SANsurfer iSCSI HBA Manager, HBA Option** dialog, click the **BIOS** tab, as shown in [Figure 71](#).

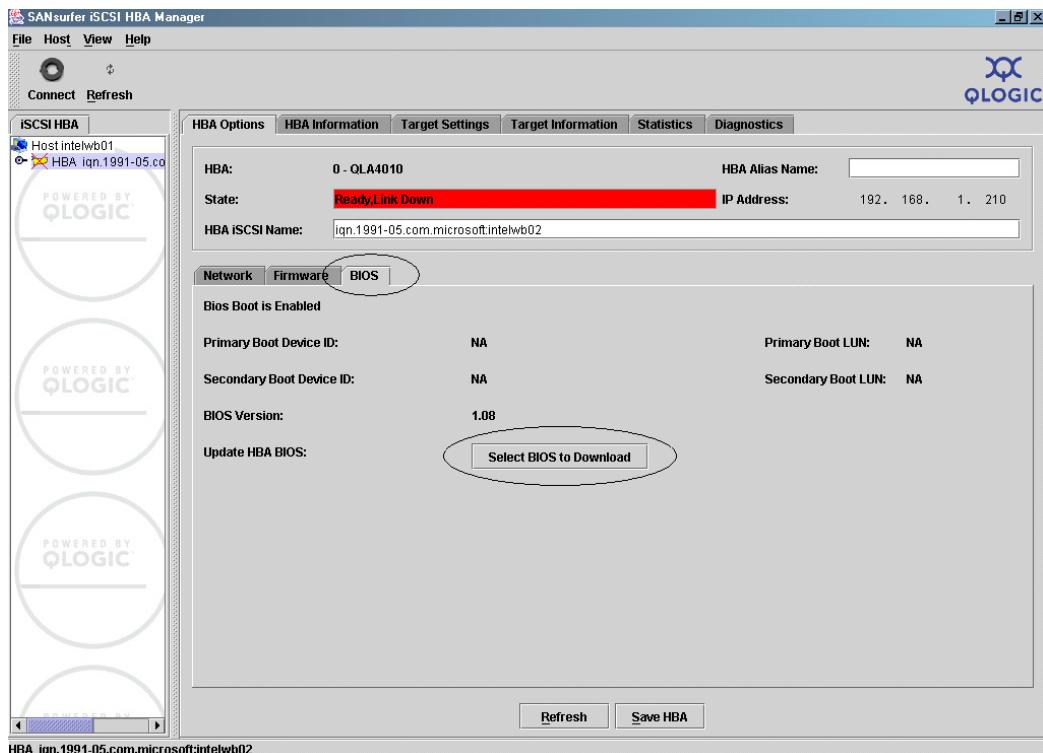


Figure 71 SANsurfer iSCSI HBA Manager, HBA Options, BIOS tab

- ◆ To configure your iSCSI targets, click the **Target Settings** tab from the **SANsurfer iSCSI HBA Manager** dialog, as shown in [Figure 72](#).

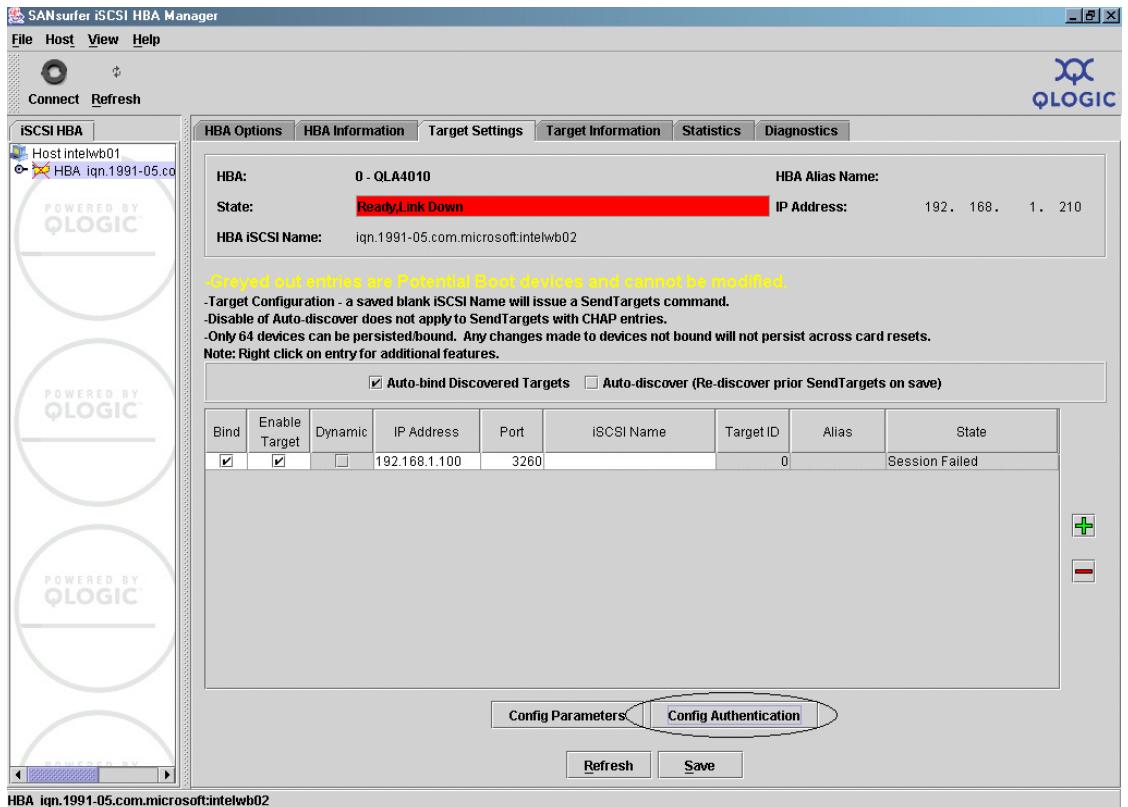


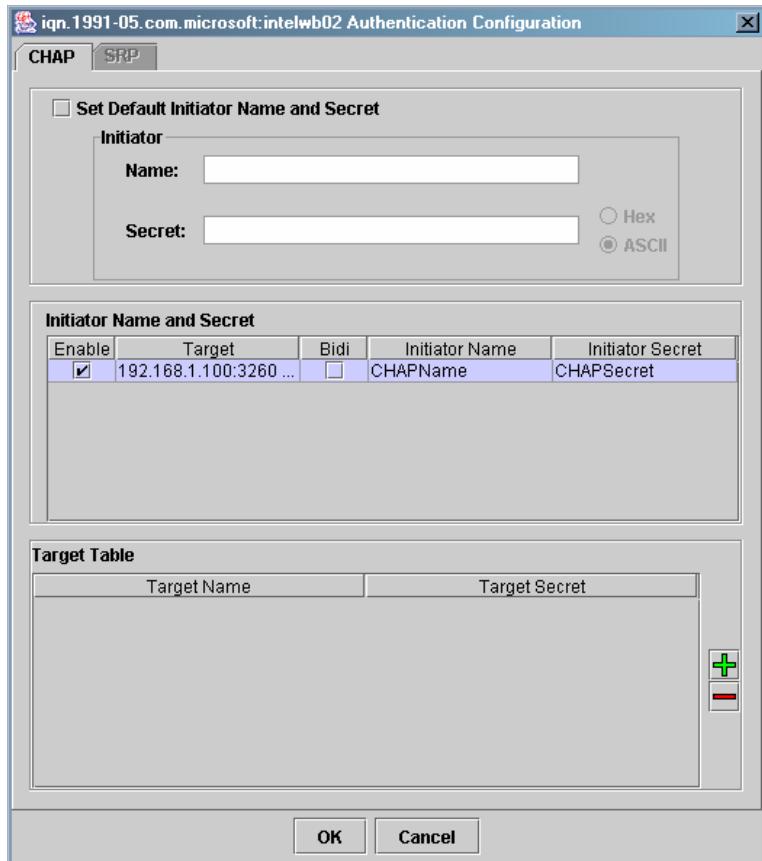
Figure 72 SANsurfer iSCSI HBA Manager, Target Settings tab

- ◆ To add your target, click the green + on the right side of the **Target Settings** tab to get the **IP Address** dialog, as shown in [Figure 73](#). Enter the IP address of your target port, and click OK.



Figure 73 SANsurfer iSCSI HBA Manager, Target Settings, IP Address dialog

- You can add as many targets as needed. If you need to enter CHAP security for any target, click **Config Authentication** at the bottom of the dialog, as shown in [Figure 72 on page 96](#), to get the **Authentication Configuration** dialog, shown in [Figure 74](#).

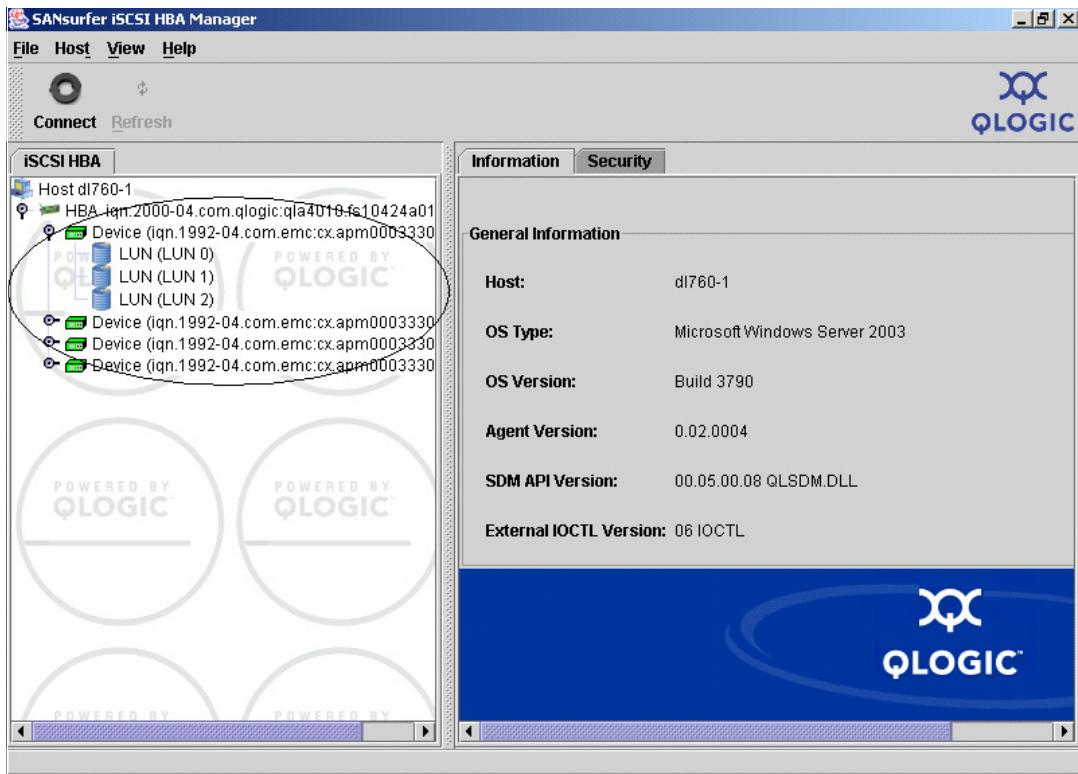


**Figure 74** Authentication Configuration, CHAP tab

- ◆ On the **Authentication Configuration, CHAP tab**, you can:
  - Set a default name and secret for all targets; or
  - Click the individual target and enter an unique name and secret settings for that target.

**Note:** Initiator CHAP settings do not get masked and could be compromised if an unauthorized user accesses the SANsurfer workstation.

- ◆ After CHAP settings are made, click **OK** at the bottom of the **Authentication Configuration** dialog, as shown in [Figure 74 on page 97](#).
- ◆ To save all target settings, click **Save** at the bottom of the **SANsurfer iSCSI HBA Manager, Target Settings** tab, as shown in [Figure 72 on page 96](#). You will be prompted for the SANsurfer security password. The default password is **config**, but it can be changed.
- ◆ After the settings are saved, SANsurfer resets the HBA, and if target information was discovered properly, you will see active connections listed on the **SANsurfer iSCSI HBA Manager, Target Information** tab. You can also view active targets under the HBA in the left pane as shown in [Figure 75](#).



**Figure 75** SANsurfer iSCSI HBA Manager, Information tab

SANsurfer has other features that are useful in managing your iSCSI storage configuration. Please refer to the QLogic SANsurfer documentation for more information about these additional features.

## Booting from SAN with QLogic QLA40xx and Microsoft Initiator

The following procedure for booting from SAN with a QLogic iSCSI HBA with Microsoft Initiator Service is illustrated using a CLARiiON CX series storage array. Booting with a QLogic iSCSI HBA with Microsoft Initiator Service can also be done on a Symmetrix storage array. For more information, refer to Symmetrix LUN Masking documentation.

The important concept is understanding the HBA's iqn name, its relationship to persistant binding in a SAN environment, and how the Microsoft Initiator Service changes the iqn name.



### **IMPORTANT**

**Failing to change the iqn name before installing the Windows operating system will cause the host to blue screen for an inaccessible boot device when the Microsoft Initiator Service changes the iqn name after being installed.**

---

**Note:** Booting from SAN with QLA40xx and Microsoft Initiator follows the same setup configuration as boot from SAN with the QLogic QLA40xx iSCSI HBA.

---



### **IMPORTANT**

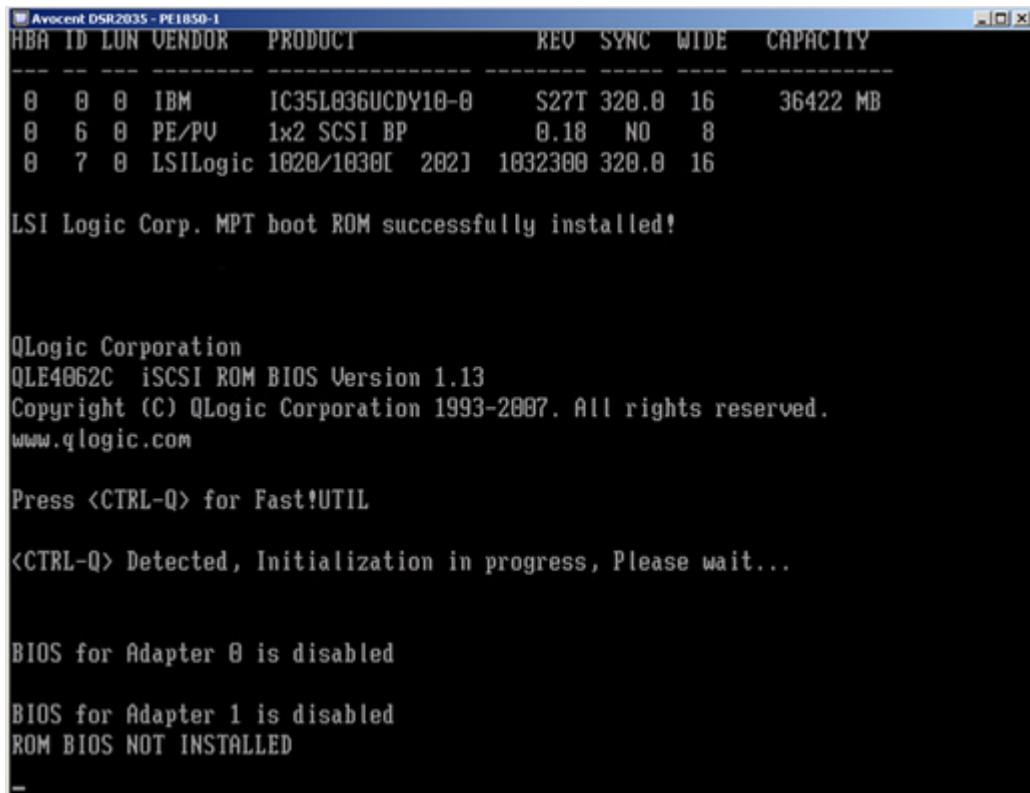
**At this point, only connect the HBA that will be used to boot. Remaining HBA(s) can be connected after the Windows operating system is installed. Failing to do so could result in a blue screen during the installation process. Best practice recommends having only the LUN you will be booting from presented to the host. This will ease the process of selecting the correct boot LUN during the HBA configuration and during the O/S installation. Remaining LUNS can be added after the installation.**

1. The first step is to know what you are going to name your server and how that translates into an iqn name. Microsoft Initiator uses the following naming convention: iqn.1991-05.com.microsoft :servername.domainname. Therefore, if the server name is to be *test*, and the domain name is *workgroup*, then the name the Initiator will use to rename the HBA will be iqn.1991-05.com.microsoft:*test.workgroup*.

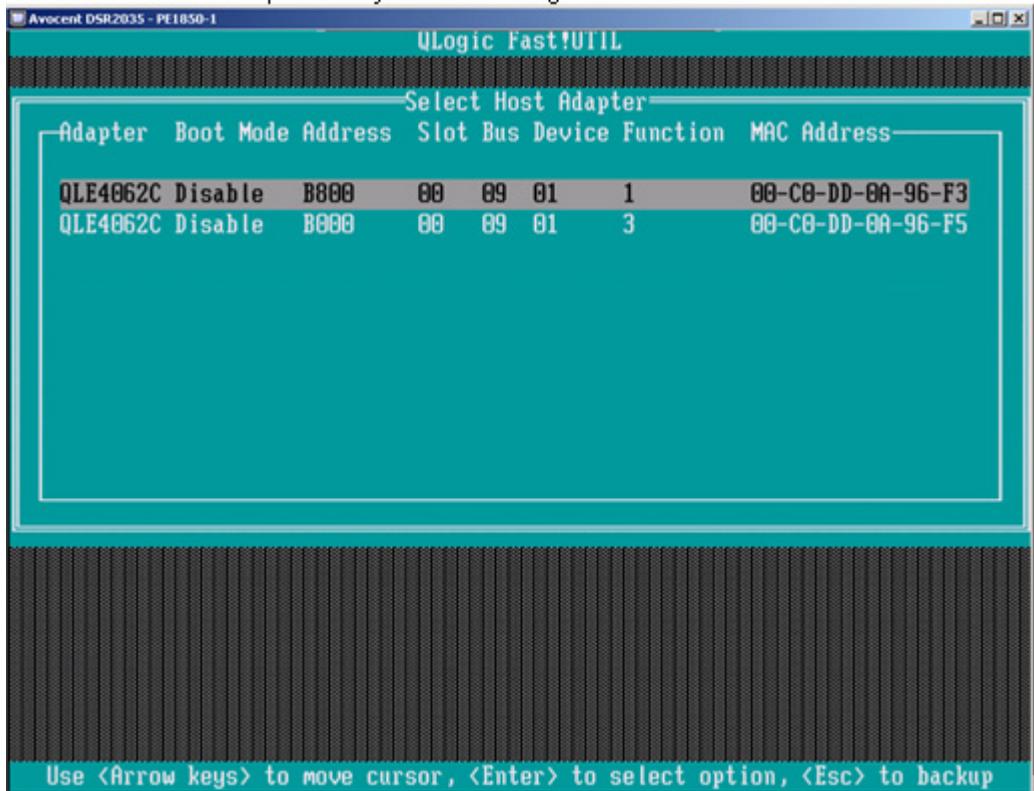
2. On the host, go into the QLogic BIOS and change the iqn name to iqn.1991-05.com.microsoft:servername. (If networking is configured during installation, set the iqn name to iqn.1991-05.com.microsoft :servername.domainname).

This can be accomplished by the following procedure:

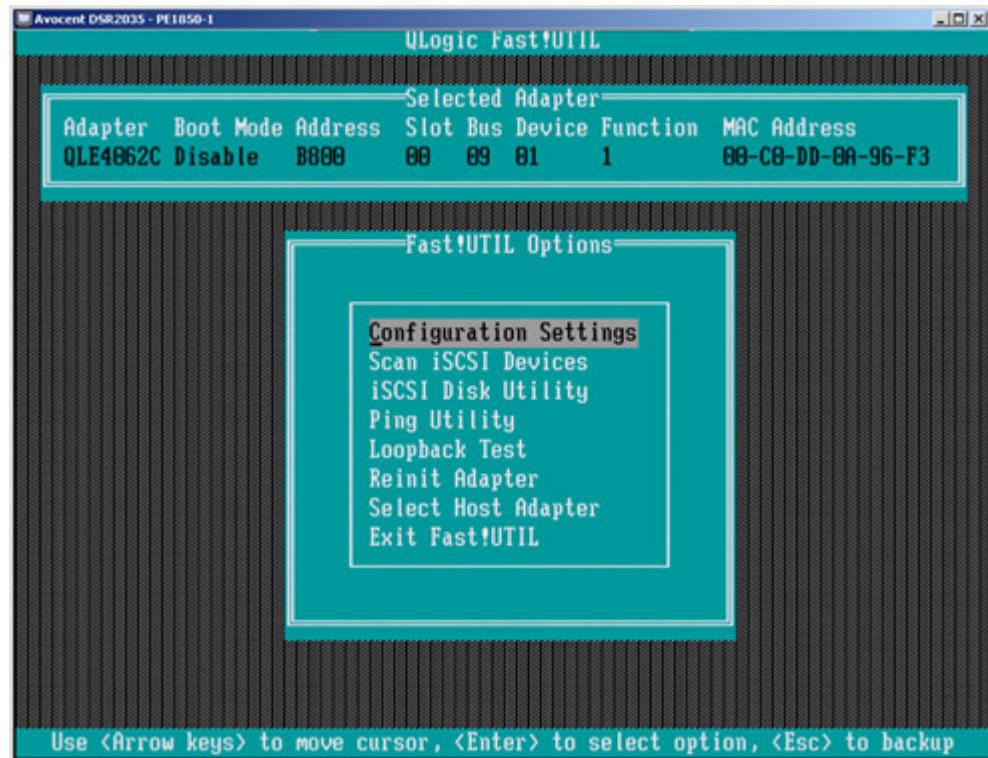
- a. On POST when the **QLogic HBA** displays, press **<Ctrl Q>** for **Fast!Util**.



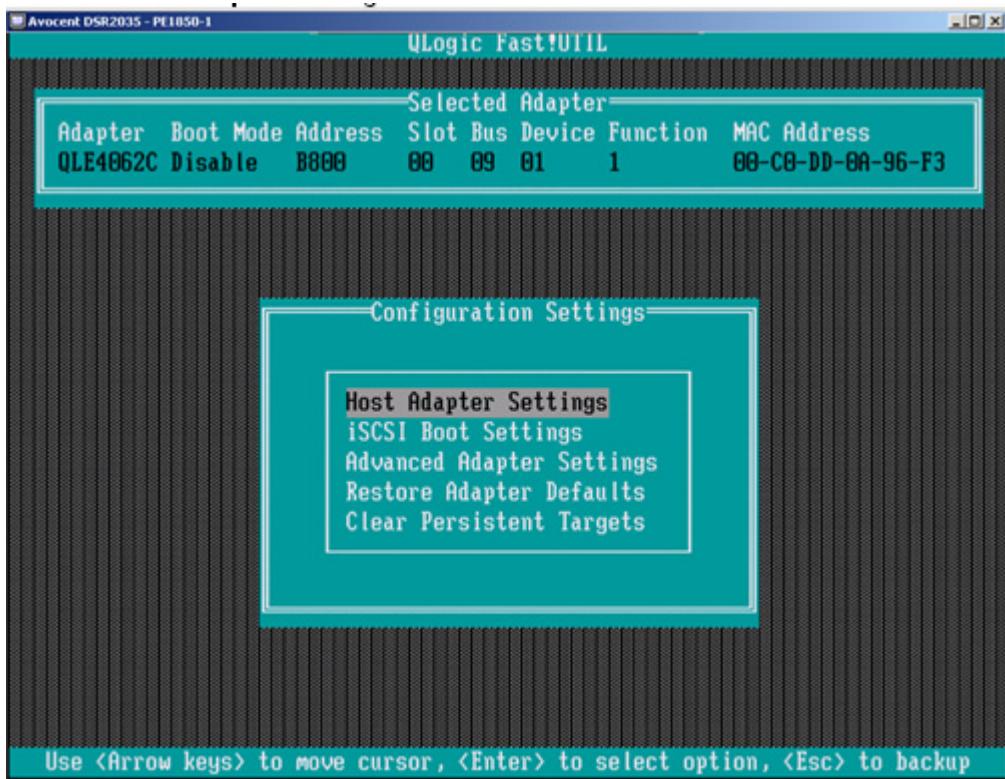
b. Select the Host Adapter that you are working with.



c. Select Configuration Settings.

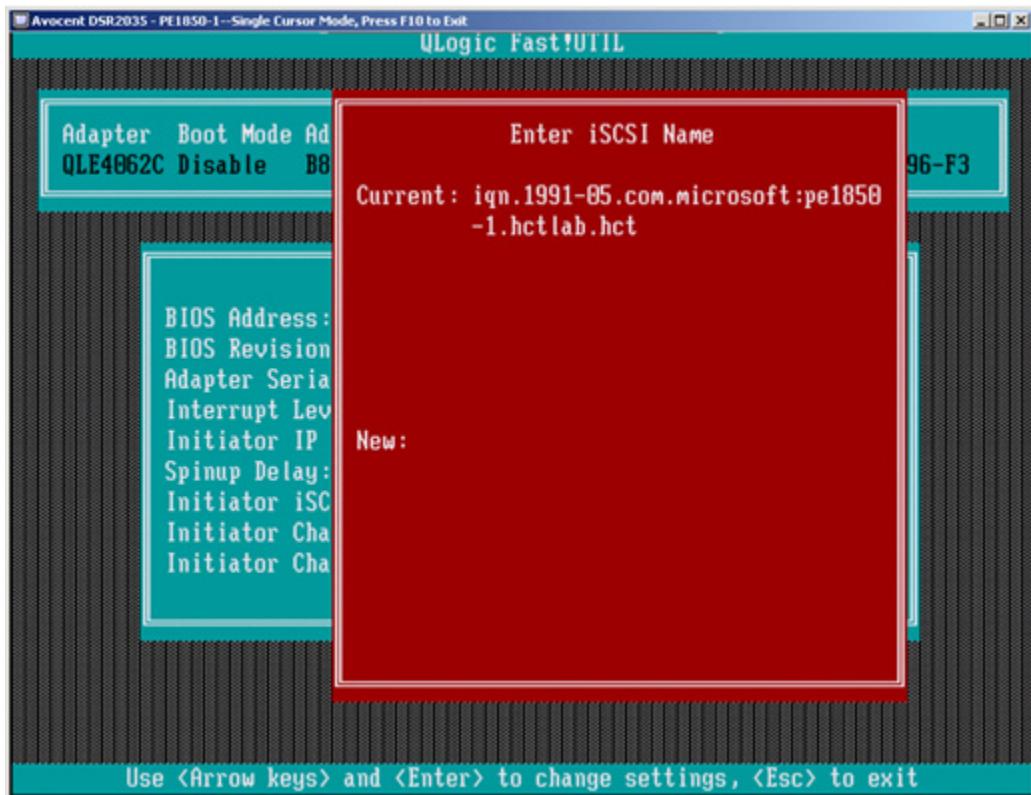


## d. Select Host Adapter Settings.



## e. Select the Initiator iSCSI Name option.

f. Press **Enter** on the name and type in the new iSCSI name.



g. Press **ESC** twice and **Save Settings** when prompted. This will force a login to the storage device.

3. Register the new iqn name and add it to your storage group on the CLARiiON storage array.

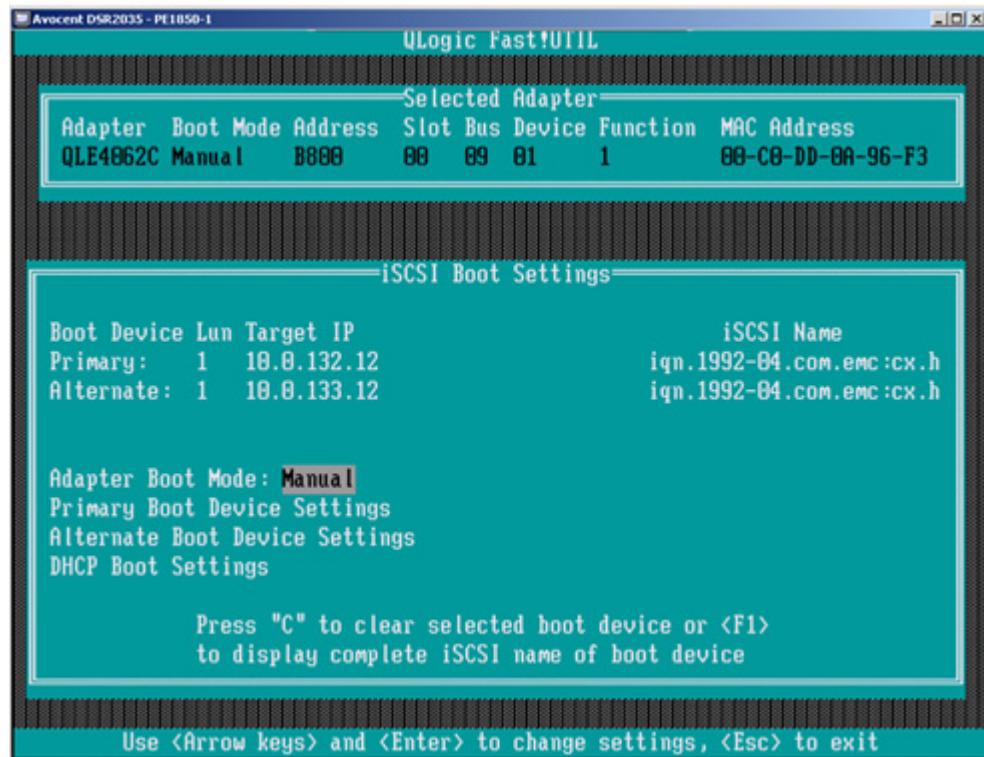
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**Note:** Only register one path. Ensure that the path is from the SP that the lun belongs to. Failing to do so could result in a blue screen during the installation process. You can also refer to CLARiiON documentation for a more detailed procedure for setting up Storage Groups and Registering host names.

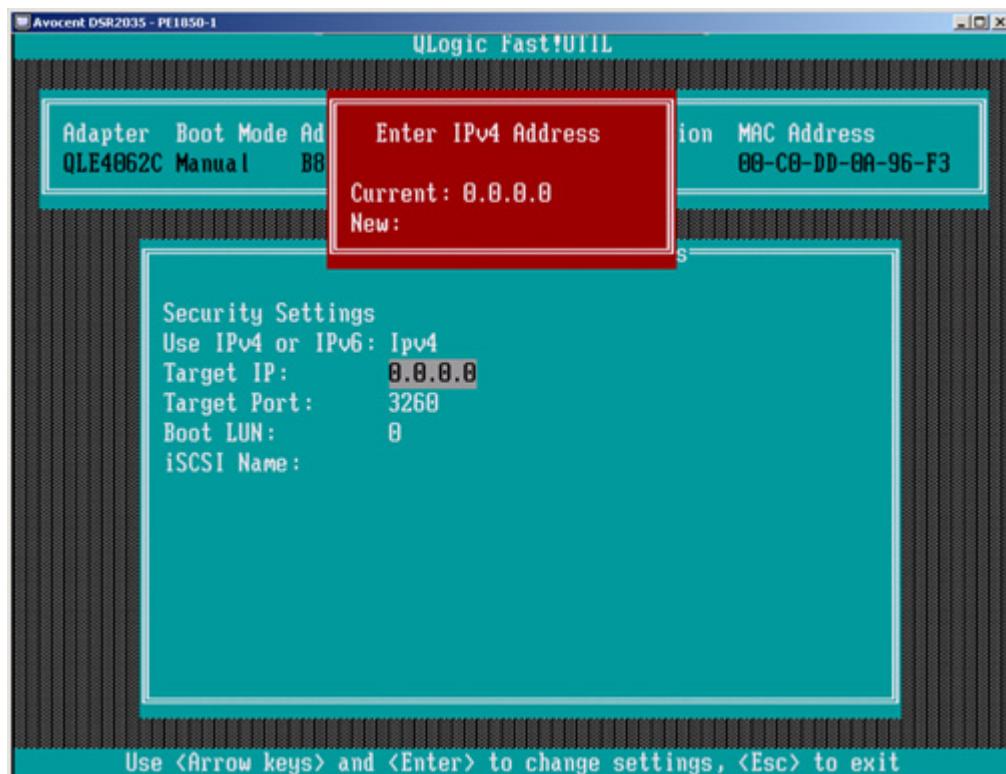
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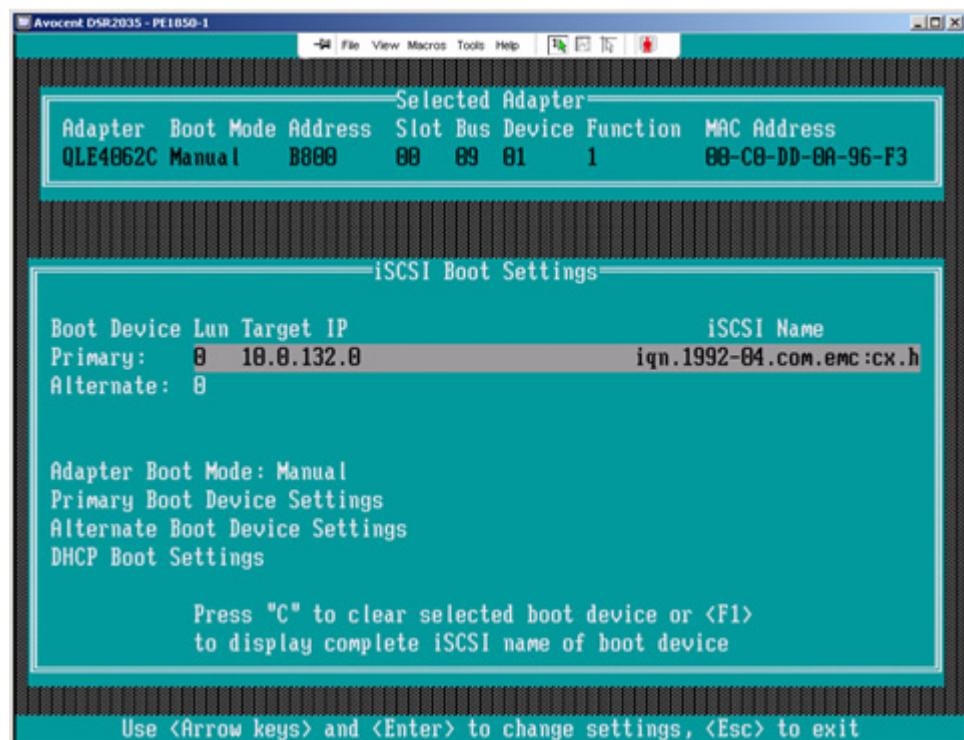
4. On the host in the **QLogic Fast!Util**, go to the **iSCSI Boot Settings**.

5. Under the **Adapter Boot Mode** option, set to **Manual**. This will bring you to the device list page.

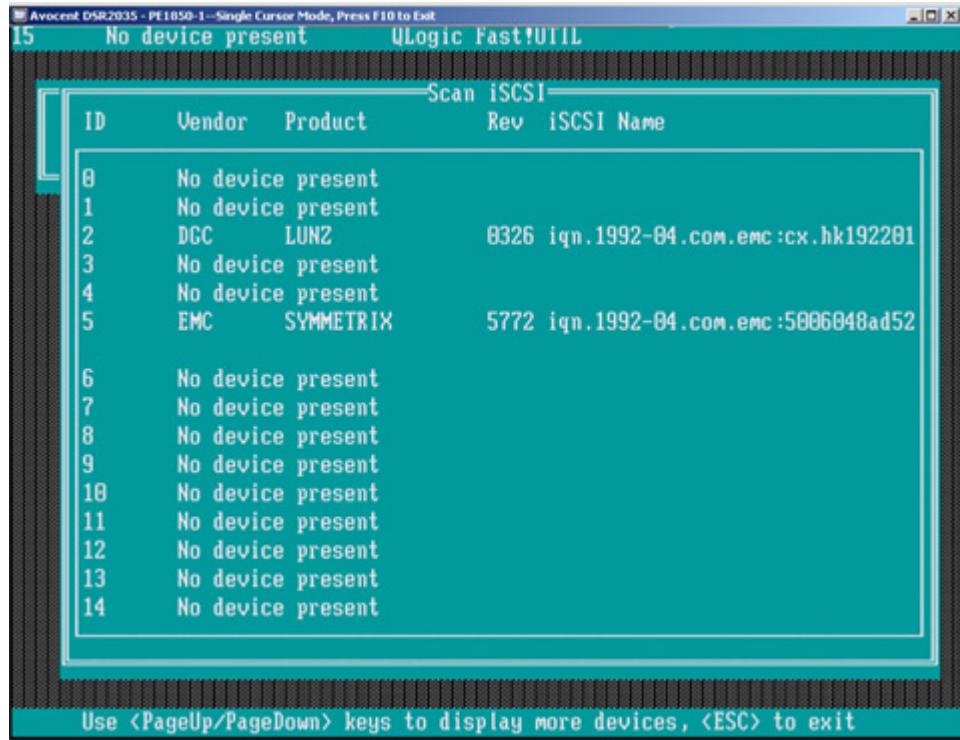


6. Under the **Primary Boot Device** option, add the target information, IP address, and iSCSI name.



7. Select the **Primary** target information.

8. Select the boot LUN you wish to use.



9. **Save** all settings and **reboot** the host and **load** the Operating System. Refer to “[Installing the Windows operating system](#)” on [page 51](#).
10. After the operating system is loaded and before the initiator service is loaded, **register** the remaining paths on the CX storage array.
11. Install the **Initiator Service** for Windows 2003 only. Windows 2008 has the iSCSI Initiator Service built in.
12. During the Microsoft Initiator installation, *deselect* the **Software Initiator**. ONLY install the Initiator Service. This will attempt to change the iqn name to fit the Microsoft naming convention. Since this was done in [Step 2](#), it will not blue screen the host for an inaccessible boot device.

## Boot-from-SAN configuration restrictions

Refer to the [EMC Support Matrix](#) for any specific boot-from-SAN restrictions. This guide no longer contains restriction information, and the information in the [EMC Support Matrix](#) supersedes any restriction references found in previous HBA installation guides.

Further information on booting Microsoft Windows from external storage can be found in the [EMC Host Connectivity Guide for Windows](#).

### Benefits of booting from the storage array

Benefits of storage-based booting include:

- ◆ Faster replacement/addition of server capacity, enabled by separation of the boot image from the server.
- ◆ Lower investment in internal server-based RAID cards with limited capability.
- ◆ Leveraged investment in the storage network through the high availability, data integrity, and storage management of an external RAID storage system.
- ◆ Leveraged commodity high-density server technology and centralized storage offered by diskless servers using SAN-attached storage systems.

Booting from the EMC storage array works effectively with certain SAN-based environments, including multiserver redundant applications, Web farms, and terminal server applications where an  $n+1$  server environment protects customers against different types of failures.

Some applications may not be optimized for storage array-based booting. EMC strongly recommends customers fully investigate their application and data availability requirements and consult with an EMC account team to determine the configuration that best meets their needs.

## Setting up external boot for IBM BladeCenter server HS40 (8839)

This section contains the following information:

- ◆ [“Configuring an HS40 BladeCenter server to boot from an external array” on page 110](#)
- ◆ [“Blade server restrictions” on page 111](#)

### Configuring an HS40 BladeCenter server to boot from an external array

IBM HS40 (8839) BladeCenter servers encounter a dual-port HBA conflict when attempting to configure boot BIOS to boot from an external array. To configure an HS40 BladeCenter server to boot successfully follow the steps below.

1. Create a single zone containing the HBA port from which you want to boot. This prevents any conflicts with the other fibre port.
2. Configure the QLogic BIOS to boot from the EMC array as described earlier in [“QLogic Fibre Channel HBA BIOS/boot LUN settings” on page 26](#). During server POST, be sure that the QLogic banner displays the selected boot LUN correctly before continuing.
3. Reboot the host and press **F1** to enter the server **BIOS Configuration/Setup Utility**.
4. Select **Devices and I/O Ports** and press **Enter**.
5. Select **IDE Configuration Menu** and press **Enter**.
6. Select the **Onboard PCI IDE Controller** and press **Enter**. Under the options menu, set this IDE Controller to disabled. This will disable the internal IDE disk drives.
7. Press **ESC** twice to return to the **IDE Configuration Menu** and then select **Start Options** and press **Enter**.
8. Select **Startup Sequence Options** and press **Enter**.
9. Select **Third Startup Device** and press **Enter**.
10. Select **HAx PortID xxxxxx xxxx** and press **Enter**. This boot device will be replaced as the **Third Startup Device** in the **Startup Sequence Options**.
11. Press **ESC** until you are prompted to save your changes. Then exit the **BIOS Configuration/Setup Utility**.

## Blade server restrictions

[Table 3](#) describes QLogic software support for the Blade servers.

**Table 3 Blade servers/QLogic software support matrix**

Blade server manufacturer	SANsurfer Install Wizard for Windows	SANsurfer FC HBA Manager for Windows
Dell	No	Yes
HP	No	Yes
IBM	No	Yes

## Manually installing the HBA driver - Advanced users

To use EMC storage array disks with a Windows host, you need an EMC-qualified Fibre Channel HBA driver. The HBA kit includes an EMC-approved driver, which must be installed and configured prior to partitioning the storage array disks. You also should check the QLogic website for the latest EMC-approved version. Refer to [“Downloading latest QLogic drivers/firmware/BIOS files” on page 16](#).

These procedures are necessary if not using the SANsurfer HBA Install Wizard. Refer to [“Installing HBA driver and software utilities” on page 69](#).

### Driver revision

History	Driver support is as follows:
	<ul style="list-style-type: none"><li>◆ Version 8.1.5.20 – QLA22xx, QLA23xx (no CX200 series direct-connect dual host cluster), Windows 2000</li><li>◆ Version 8.1.5.21 – QLA23xx, Windows 2000</li><li>◆ Version 8.2.1.20 – QLA23xx, Windows 2000</li><li>◆ Version 8.2.2.20 – QLA23xx STORPort, Windows 2003 only</li><li>◆ Version 8.2.2.25 – QLA23xx, Windows 2000 and Windows 2003</li><li>◆ STORPort 8.2.3.26 and SCSIPort 8.2.3.21 – QL23xx, Windows 2003 (SCSI and STOR) and Windows 2000 (SCSI only)</li><li>◆ STORPort Version 8.2.3.27 – QLA23xx, Windows 2003 only</li><li>◆ STORPort 9.0.0.17 and SCSIPort 9.0.0.12 – QL23xx, Windows 2003 (SCSI and STOR) and Windows 2000 (SCSI only)</li><li>◆ STORPort 9.0.1.18 Stratus computers only and SCSIPort 9.0.0.12 – QL23xx, Windows 2003 (SCSI and STOR) and Windows 2000 (SCSI only)</li><li>◆ STORPort 9.0.1.17 and SCSIPort 9.0.1.12 – QL23xx, Windows 2003 (SCSI and STOR) and Windows 2000 (SCSI only)</li><li>◆ STORPort 9.0.1.15 and SCSIPort 9.0.1.10 – Dell 2342M/2362M embedded adapters, Windows 2003 (SCSI and STOR) and Windows 2000 (SCSI only)</li></ul>

- ◆ STORPort 9.0.2.17 and SCSIPort 9.0.2.12 – QLA23XX, snf WLzr 23XX, Windows 2003 (SCSI and STOR) and Windows 2000 (SCSI only)
- ◆ STORPort 9.1.0.15 and SCSIPort 9.1.0.10 – QLA23XX, QLE 23XX, QLA24XX, QLE24XX, Windows 2003 (SCSI and STOR) and Windows 2000 (SCSI only)
- ◆ STORPort 9.1.2.15 and SCSIPort 9.1.2.10 – QLA23XX, QLE 23XX, QLA24XX, QLE24XX, Windows 2003 (SCSI and STOR) and Windows 2000 (SCSI only)
- ◆ STORPort 9.1.2.16 and SCSIPort 9.1.2.11 – QLA23XX, QLE 23XX, QLA24XX, QLE24XX, Windows 2003 (SCSI and STOR) and Windows 2000 (SCSI only)
- ◆ STORPort 9.1.4.15 and SCSIPort 9.1.4.10 – QLA23XX, QLE 23XX, QLA24XX, QLE24XX, and embedded OEM HBAs. Windows 2003 supports STORPort driver only and Windows 2000 supports SCSIPort driver only.
- ◆ STORPort 9.1.4.15L for Windows 2008 – QLA23XX, QLE 23XX, QLA24XX, QLE24XX, and embedded OEM HBAs.
- ◆ STORPort 9.1.7.16 for Windows 2003 and 2008 – QLA23xx, QLE23xx, QLA24xx, QLE24xx, QLE256x, and embedded OEM HBAs.

**Note:** Windows 2008 supports STORPort drivers only.

---

## Where to find the driver

You can find the Fibre Channel HBA driver:

- ◆ On the QLogic CD-ROM that accompanied the HBA. Copy the driver from the OS-specific directory: \Windows2000 or \Windows2003
- ◆ On the QLogic website. Refer to [“Downloading latest QLogic drivers/firmware/BIOS files” on page 16](#)

To ease installation of the driver, unzip the driver file onto a blank diskette.

## Windows 2003 STORPort updates

Currently the shipping version of Windows 2003 requires post-RTM hot fixes to resolve some known issues. For all Windows 2003 STORPort installations, you should obtain the current Microsoft QFE hotfix listed in the [EMC Support Matrix](#) with the HBA driver revisions.

Install this patch before installing the HBA driver. Windows 2003 Service Pack 1 or later (x86 and IA64) and Windows 2003 x64 contain the latest STORPort hot fix and does not require a post-RTM QFE.



### IMPORTANT

**EMC recommends that users planning to upgrade to Service Pack 1 or later for Windows 2003 should upgrade their HBA drivers to the latest supported version prior to installing the service pack.**

## Migrating Windows 2003 drivers from SCSI to STOR

As of April 2006, STORPort has been fully adopted by third-party software and tape vendors and EMC is proceeding towards sole STORPort support under Windows 2003. Adding to the technical benefits of STORPort, phasing-out SCSI miniport on Windows 2003 will provide better coordination of driver version support from OEMs. STORPort will be the common driver platform for all server and storage vendors to provide the customer with compatible solutions.

In the April 2006 [EMC Support Matrix](#) (ESM), EMC will make SCSI driver releases for Windows 2003 x86 from QLogic frozen as the last supported Windows 2003 SCSI versions. Once this end-of-life (EOL) is in effect, new installs will still be permitted with the SCSI drivers for three months, but EMC encourages customers to use STORPort instead. Three months after the EOSL (after the June ESM) EMC will make these Windows 2003 SCSI versions EOL. Upon EOSL, starting with the July ESM, the Windows 2003 SCSI versions will no longer be listed and will not be supported for new installations. Existing customers who have Windows 2003 SCSI already installed will be supported, and any fix or MS HCL support will likely require an upgrade to STORPort. Windows 2000 will continue to use SCSI drivers as the only option.

### What to expect when moving from SCSI miniport/Full Port drivers to STORPort drivers

In STORPort drivers, functions or settings that users may have set may no longer be available or may be accessed differently than in the past. These are now controlled by the OS. EMC has always provided standard settings which were accessible via driver configuration utilities. For STORPort drivers, EMC will require that the default settings for STORPort drivers be used unless otherwise instructed. Configuration utilities for STORPort that run under Windows (SANSurfer as well as the Qlogic Ease of Use installation kit), will allow access to settings for the driver that may be changed via the utility if necessary.

---

### Manual driver installation procedure for Windows 2000, 2003, or Windows 2008 hosts

To install the driver into a Windows 2000, 2003, or Windows 2008 host, follow these steps:

1. Boot the host with Windows 2000, 2003, or Windows 2008.
2. Right-click the **My Computer** icon and select **Manage**.
3. In the left pane of the **Computer Management** window (**Server Manager** window on Windows 2008), click the **Device Manager**. (On Windows 2008, the **Device Manager** is located under the **Diagnostics** item.)
4. If Windows Plug-n-Play does not detect your HBA(s), it will be listed as **Unknown** or as a **Fibre Channel Controller** under the **Other Devices** icon in the right pane. If the Windows Plug and Play service has detected your HBA, the HBA will already be listed under **SCSI and RAID Controllers**. (On Windows 2008, they will appear under **Storage Controllers**.) If your HBAs have already been detected, follow the instructions under [“Updating the HBA driver in a Windows 2000, 2003, or Windows 2008 hosts” on page 117](#). Otherwise, double-click the first instance of controller under **Other Devices**.
5. In the next window, click **Update Driver**, then **Next**.
6. Perform one of the following:

- For Windows 2000, click the **Next** button on the welcome screen. On the next screen, you will be asked what you want the wizard to do, click **Display a list of known drivers for this device so that I can choose a specific driver**, and click **Next** then Jump to [Step 7](#).
- For Windows 2000 & 2003, you will be asked if you wish to connect to Windows Update to search for software, click **No, not at this time**, and click **Next**. On the next screen, you will be asked to install software automatically, or install from a list or generic location. Choose **Install from a list or generic location [Advanced]**, and click **Next**. On the next screen, you are asked to choose your search and installation options, click **Don't search. I will choose the driver to install**, and click **Next**. Select **SCSI & RAID Controllers** from the list, and click **Next** then Jump to [Step 7](#).
- For Windows 2008, you will be asked how you want to search for the driver. Click **Browse my computer for driver software**. On the next screen, you are given options on how to browse for driver software on your computer, click the option to **Let me pick from a list of device drivers on my computer**. Continue to [Step 7](#).

7. In the next window, click the **Have Disk** button.
8. Enter the path to the diskette containing the driver (A:\, for example), or use the browse function to locate the driver; then click **OK**.
9. Select the appropriate driver for your HBA from the displayed list and click **Next**.

---

**Note:** If you select the wrong driver, you will receive an **Incompatible Hardware** warming message. Select **No** to cancel the update and return to the selection windows, and then select the correct driver.

10. If prompted, in the next window, click **Next**.
11. If prompted, click **Yes** to continue the installation. (Windows 2008 may not display this.)
12. Click **Finish** to complete the installation. Windows 2008 has a **Close** button.
13. If the system requests that you reboot the system, select **No**; then click **Close**.

14. If the system again requests that you reboot the system, select **No**; then click **Close**.
15. If you have other adapters to update, select the next adapter in the device manager and repeat steps **Step 6** through **Step 14**.
16. When all adapters have their drivers updated, select **Yes** to the reboot prompt.

If you are not prompted to reboot, reboot your server anyway.

---

## Updating the HBA driver in a Windows 2000, 2003, or Windows 2008 hosts

On Windows 2000, 2003, and Windows 2008 systems where the QLogic HBA has been detected automatically or a driver is already installed, it may be necessary to update the current driver to the latest EMC-qualified driver, as described in this section.

The following procedure assumes that you have copied the latest driver from the QLogic CD-ROM or downloaded it from the QLogic website and put it onto a diskette. Refer to the release notes provided with the driver for information that might be unique to new driver revisions.

To install the driver into a Windows 2000, 2003, or Windows 2008 host:

1. Boot the host (if necessary) with Windows 2000 or Windows 2003.
2. From the Windows taskbar, click **Start> Programs> Administrative Tools> Computer Management**.
3. In the left pane of the Computer Management window, click the **Device Manager** icon.
4. For Windows 2000 and 2003, double-click the **SCSI & RAID Controllers** icon. For Windows 2008, double-click the **Storage Controllers** icon.
5. Under **SCSI & RAID Controllers** or **Storage Controllers**, double-click the adapter you want to upgrade.
6. In the next window, click the **Driver** tab; then click **Update Driver**.

## 7. Perform one of the following:

- For Windows 2000, click the **Next** button on the welcome screen. On the next screen, you will be asked what you want the wizard to do. Click **Display a list of known drivers for this device so that I can choose a specific driver** and then click **Next**. Continue to [Step 8](#).
- For Windows 2000 and 2003, you will be asked if you wish to connect to Windows Update to search for software. Click **No, not at this time** and then click **Next**. On the next screen, you will be asked to whether you want to install software automatically or to install software from a list or generic location. Choose **Install from a list or generic location [Advanced]** and click **Next**. On the next screen, you are asked to choose your search and installation options. Click **Don't search. I will choose the driver to install** and then click **Next**. Select **SCSI & RAID Controllers** from the list and then click **Next**. Continue to [Step 8](#).
- For Windows 2008, you will be asked how you want to search for the driver. Click **Browse my computer for driver software**. On the next screen, you are given options on how to browse for driver software on your computer. Click the option **Let me pick from a list of device drivers on my computer**. Continue to [Step 8](#).

8. In the next window, click **Have Disk**.9. Enter the path to the diskette containing the driver (A:\, for example), or use the browse function to locate the driver; then click **OK**.10. Select the appropriate driver for your HBA from the displayed list and click **Next**.

---

**Note:** If you select the wrong driver, you will receive an **Incompatible Hardware** warming message. Select **No** to cancel the update and return to the selection windows, and then select the correct driver.

---

11. If prompted in the next window, click **Next**. (Windows 2008 may not display this.)12. If prompted, click **Yes** to continue the installation. (Windows 2008 may not display this.)13. Click **Finish** to complete the installation. Windows 2008 will have a **Close** button.

14. If the system requests that you reboot the system and you have other adapters to update, select **No** and then click **Close**.
15. If the system again requests that you reboot the system and you have other adapters to update, select **No** and then click **Close**.
16. If you have other adapters to update, select the next adapter under **SCSI & RAID Controllers** and repeat **Step 6** through **Step 15**.
17. When all adapters have their drivers updated, select **Yes** to the **reboot** prompt.

If you are not prompted to reboot, reboot your server anyway.

For more information on connecting to a SAN and installing drivers/firmware on HP Proliant BL p-Class server blades, refer to HP documentation on the HP Business Support site at <http://h20000.www2.hp.com/bizsupport/TechSupport/Home.jsp>.

---

## Upgrading to Windows 2003 from Windows 2000

Note the following if upgrading to Windows 2003:

- ◆ Upgrading from Windows 2000 - The Windows 2000 drivers may be preserved while upgrading to Windows 2003. These SCSIPort drivers (including the native Windows 2003 SCSIPort drivers) are not supported by EMC for Windows 2003. You should obtain the correct Windows 2003 drivers. Refer to ["Downloading latest QLogic drivers/firmware/BIOS files" on page 16](#), and reinstall the drivers after the upgrade is complete.
- ◆ Currently, to upgrade from Windows 2000 to Windows 2003, you must first uninstall PowerPath. After upgrading the host, you can reinstall an approved Windows 2003 version. Please refer to the EMC PowerPath documentation for further details. You may wish to disconnect your storage during the Windows upgrade, and reconnect it after the approved Windows 2003 drivers are installed.

## Editing the Windows time-out value

While QLogic drivers will set the Window disk timeout value to 60 seconds automatically, some software applications may change the timeout value to another value. The following procedure describes how to manually change the Windows disk timeout value to 60 seconds.

Connecting a Windows host to an EMC storage array over Fibre Channel requires editing the Windows registry as follows:

1. Open the registry:
  - a. On the Windows taskbar, click **Start**.
  - b. Click **Run**.
  - c. Type **regedit32.exe** in the **Open** field and click **OK**.
2. Follow this path:  
HKEY\_LOCAL\_MACHINE\ System\ CurrentControlSet\, Services\ Disk
3. Look for the **TimeOutValue** entry in the right pane of the registry editor window:
  - If the **TimeOutValue** exists, double-click it, then go to step 4.
  - If the **TimeOutValue** does *not* exist:
    - a. Select **Add Value** from the **Edit** menu.
    - b. In the **Value Name** box, type **TimeOutValue** (exactly as shown).
    - c. For the data type, select **REG\_DWORD** from the pull-down menu.
    - d. Click **OK**.
4. In the **DWORD Editor** window:
  - a. Click **decimal** in the **radix** box.
  - b. Change the value in the **data** box to **60**.
5. Click **OK**.
6. Close the registry editor.
7. Reboot the host.

## QLogic advanced utilities

This section contains the following information:

- ◆ “[Updating QLogic firmware/BIOS and applying NVRAM settings](#)”, next
- ◆ “[Updating the flash BIOS using SANsurfer FC HBA Manager](#)” on page 122
- ◆ “[Updating the flash BIOS using SANsurfer FC HBA Manager](#)” on page 122
- ◆ “[Procedure for replacing a QLogic HBA in Stratus ftServers without rebooting](#)” on page 125

### Updating QLogic firmware/BIOS and applying NVRAM settings

EMC-approved HBA firmware/BIOS must be applied to your HBA before connecting to, and running I/O on, EMC Storage Arrays.

There are two ways to flash updated firmware/BIOS files to your HBA:

- ◆ From QLogic SANsurfer Management Software
- ◆ From a DOS command prompt.

To use SANsurfer Management Software to update firmware/BIOS on your HBA when Windows is running, refer to “[Updating the flash BIOS using SANsurfer FC HBA Manager](#)” on page 122 for instructions.

---

**Note:** Current 64-bit systems can only be updated with QLogic SANsurfer Management Software.

If you are updating the firmware/BIOS of an HBA installed in a 32-bit system that is not running the SANsurfer software, use the procedure described in the “[Install/upgrade firmware and boot BIOS from DOS](#)” on page 25.

## Updating the flash BIOS using SANsurfer FC HBA Manager



### **WARNING**

*Changing flash BIOS incorrectly can cause serious damage to your system.*

Perform the following steps to update the flash BIOS:

1. In the SANsurfer FC HBA Manager main menu HBA tree, select the adapter.

If you want to configure multiple adapters with the same settings, hold the **CTRL** key while selecting multiple adapters. The adapters must be in the same series:

QLA231x HBAs, QLA234x HBAs, QLA246x HBAs, QLE246x HBAs, or QLA22xx HBAs.

**Note:** Only the Settings (Adapter Settings and Advanced Adapter Settings) and Utilities tabbed pages can be configured for multiple adapters; therefore, the remaining tabbed pages do not display when multiple adapters are selected.

2. Click the **Utilities** tab. The Utilities page displays (see [Figure 76 on page 123](#)).



### **IMPORTANT**

If you selected multiple adapters, the Save Flash and Save NVRAM radio buttons do not display. These options cannot be performed with multiple adapters. Some versions of SANsurfer may have buttons referring to Flash, Option ROM, or Boot Code. These all refer to the HBA BIOS.

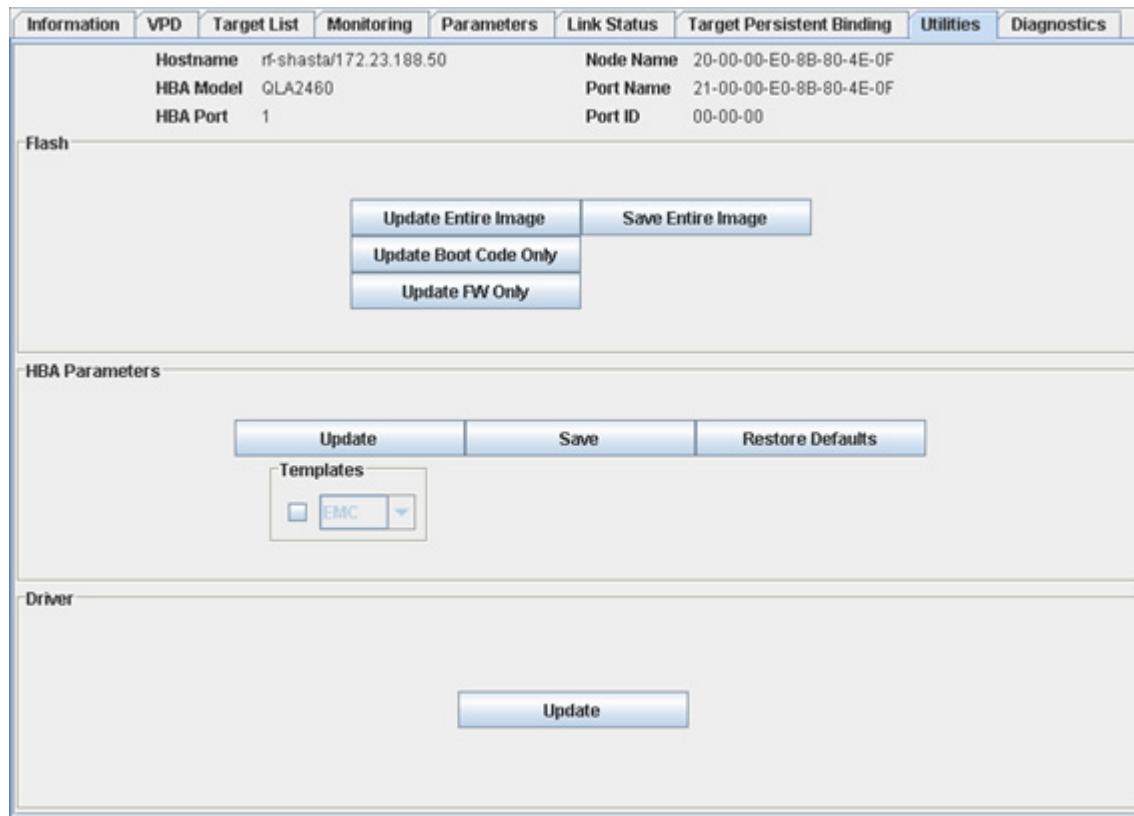


Figure 76 Utilities tabbed page

The identifying information displays:

- **Host:** Name of the host connected to the adapter.
- **Adapter:** Adapter number and type.
- **Node Name:** World Wide adapter node name.
- **Port Name:** World Wide adapter port name.
- **Port ID:** Port ID of the adapter.

3. Click the **Update Entire Image** button to update the Boot BIOS. Since EMC kits are provided as universal kits, the entire flash image must be used.
4. Select the file that contains the flash BIOS. You can obtain this file from the QLogic website. Refer to [“Downloading latest QLogic drivers/firmware/BIOS files”](#) on page 16. The file typically ends

with .bin, such as ql22rom.bin. If you select a file that is not an acceptable flash BIOS file for the adapter, the **not an acceptable flash BIOS** data file message displays. Select a valid file, then click **OK**.

5. The **Security Check** dialog box displays. In the **Enter Password** box, type the password. Click **OK**.
6. The tabbed page appears dimmed during the update. When complete, the flash BIOS update complete message displays.
7. Reboot the system.

---

**Note:** NVRAM settings for the HBA are updated using the **Update** button under the **HBA Parameters** section of the **Utilities** screen.

---

## Procedure for replacing a QLogic HBA in Stratus ftServers without rebooting

This section contains the following information:

- ◆ “[EMC CLARiiON storage arrays](#)”, next
- ◆ “[EMC Symmetrix arrays with device masking enabled](#)” on [page 126](#)

### EMC CLARiiON storage arrays

Use of this procedure requires NAVICLI installed on the host system.

1. Remove the IO slice that contains the defective QLogic HBA.
2. Replace the defective HBA with a new HBA of same Stratus part number (that is, U525 or U526). The HBA should be inserted into the same PCI slot from which the defective HBA was removed. (Inserting the replacement HBA into another PCI slot requires a driver to be loaded for the HBA.)
3. Reinsert IO slice with the new HBA, and reconnect all cables.
4. Power up the ftServer, and let the IO Slice come online and duplex, as shown in the Stratus ftServer Management tool.
5. Change the FC switch zoning to add the WWN of the replaced HBA to the appropriate zones.
6. Restart the Navisphere Agent using the **Service Control Manager** applet.
7. In the CLARiiON Navisphere Manager, use connectivity status to verify the new HBA is present and logged in. Alternately, use the **port 'list'** command in **navicli**.
8. Using **navicli**, connect the HBA to the storage group with the following command:

```
navicli -h <Clarion IP Addr> storagegroup -connecthost
          -host <host-name> -gname <Storage-group-name>
```

This command will give the user the following prompt:

```
Connect host <host-name> to storage group
          <Storage-group-name> (y/n) ?
```

Type **y**.

9. Scan for hardware changes from the Windows device manager.
10. Execute the following commands from a command window:

```
powermt restore  
powermt display
```

At this point, two HBAs should be present in the display and the FC HBAs should be duplexed in the ftSMC. It may be necessary to repeat steps 9 and 10.

---

## EMC Symmetrix arrays with device masking enabled<sup>1</sup>

---

Use of this procedure requires SYMCLI installed on the host system (part of the EMC Solutions Enabler suite). Alternatively, EMC ControlCenter can be used to perform the HBA replacement.

---

1. Using SYMCLI, run **symmask list logins** to view the old WWN/iSCSI HBAs.
2. Remove all cables to the IO slice with the defective HBA, and remove the IO slice.
3. Replace the defective QLogic HBA with the new HBA of same Stratus part number (that is, U525 or U526). The HBA should be inserted into same PCI slot from which the defective HBA was removed. (Inserting the replacement HBA into another PCI slot requires a driver to be loaded for the HBA.)
4. Reinsert the IO slice with the new HBA, and reconnect all cables.
5. Let the IO Slice come online and duplex, as shown in the Stratus ftServer Management tool.
6. Change the FC switch zoning to add the WWN of the replaced HBA to the appropriate zones.
7. Run **symmask list hba** or **discover** to view the new initiator (for example, WWN).
8. Run **symmask replace** to substitute a new WWN for all occurrences in the database of the old WWN.

---

1. Symmetrix Arrays without device masking enabled do not require this procedure; Symmetrix Arrays with device masking enabled only require replacing the HBA WWN used in switch zoning.

9. Run **symmask discover** to establish the new names in the history table, or run **symmask rename** to assign a WWN to the new HBA in both the database and the history table.
10. Run **symmask refresh** to update the director profile tables (in cache) from the database.
11. Scan for hardware changes from the Windows device manager.
12. Execute the following commands from a command window:

```
powermt restore  
powermt display
```

At this point, two HBAs should be present in the display and the FC HBAs should be duplexed in the ftSMC. It may be necessary to repeat steps 9 and 10.

## Special instructions for the EMC CLARiiON CX200 series

This section contains the following information:

- ◆ “[Set the HBA FC-AL loop ID](#)” on page 128
- ◆ “[Direct-connect dual-host clustering configurations](#)” on page 130

### Set the HBA FC-AL loop ID

While configuring a QLA234x HBA for Windows 2000 and connection to CLARiiON CX200 series for direct-connect cluster configurations, you must manually set the HBA FC-AL Loop ID. Follow these steps to enable loop hard addressing and set the loop ID on each HBA:

Perform this procedure on all nodes in the cluster connected to the CX200 series array.

1. Boot the Windows host; press **Ctrl-Q** when prompted to **Press <CTRL-Q> for Fast!UTIL**. (This prompt appears with the QLogic startup banner.)
2. After the **Fast!UTIL** program loads, the initial display depends on whether there are multiple QLogic HBAs installed in the server:
  - If there is only one QLogic HBA, the **Fast!UTIL Options** menu appears.
  - If there are multiple QLogic HBAs, a list of memory addresses occupied by those HBAs appears.Using the arrow keys, select the desired HBA and press **ENTER**. The **Fast!UTIL Options** menu appears.
3. Select **Configuration Settings** from the **Fast!UTIL Options** menu, and press **Enter**.
4. Select **Host Adapter Settings** from the **Configuration Settings** menu.
5. Select **Adapter Hard Loop ID** from the **Host Adapter Settings** menu and press **ENTER** until the value is **Enabled**.
6. Select **Hard Loop ID** and press **Enter**.

The loop ID value entered here is the decimal representation of the FC-AL loop ID. You do not need to perform any FC-AL AL\_PA hexadecimal translation.

---

HBAs connected to the same SP should all have unique hard loop IDs. Select **0** for all HBAs on one node, select **1** for all HBAs on the next node, and so on.

---

7. Enter a value for the loop ID and press **Enter**.
8. Press **Esc** to return to the **Configuration Settings** menu.
9. Press **Esc** to return to the **Fast!UTIL Options** menu.
10. When prompted to save changes made to the current adapter, select **Save Changes** and press **ENTER**.
11. If there are more adapters to configure, choose **Select Host Adapter**, and repeat steps **3** through **11** for each adapter.
12. Press **Esc** to exit Fast!UTIL.
13. Reboot the host.
14. Repeat this procedure on all nodes in the cluster connected to the CX200 series array.
15. While you are in the BIOS, you can verify that the topology is set correctly for direct connect (FC-AL).



#### **CAUTION**

---

**Future use of the firmware NVRAM file to apply settings will overwrite and possibly invalidate the changes made above. If you will later update using a firmware NVRAM file, be sure it is listed and supports this CX200 series direct-connect cluster configuration.**

---

---

**Note:** To restore EMC default HBA settings, either reload the approved EMC NVRAM file, or return to step **5** and ensure **Adapter Hard Loop ID** is set to **Disabled**.

---

## Direct-connect dual-host clustering configurations

For CLARiiON CX200 series direct-connect dual-host cluster configurations only with QLA234x HBAs, you must follow all procedures described in this section.

### Check for an updated HBA driver

For CLARiiON CX200 series direct-connect dual-host cluster configurations with only QLA234x HBAs, you may need a separate driver and firmware download. The [EMC Support Matrix](#) notes whether separate driver and firmware files are required.

For each HBA determined to require updated firmware and drivers, follow the instructions on [“Downloading latest QLogic drivers/firmware/BIOS files” on page 16](#). Be sure to reference the Name and Description fields to select the correct CX200 series direct-connect dual-host cluster-compatible files.

### Reconfigure the HBA jumper

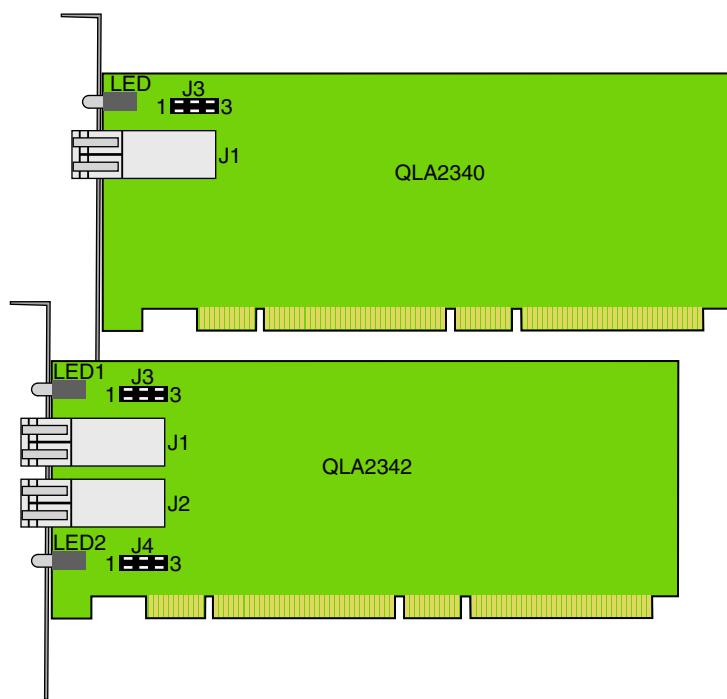
For CLARiiON CX200 series direct-connect dual-host cluster configurations with only QLA234x HBAs, you must change the default HBA optic jumper position:



#### **CAUTION**

**Modifying the jumper setting without using the recommended firmware/drivers can cause the HBA to lose connectivity.**

1. Remove the HBA from the server as instructed by your server guide.
2. Locate jumper(s) J3 (QLA2340) or J3 and J4 (QLA2342), shown in [Figure 77 on page 131](#).



**Figure 77 Reconfigure the HBA jumper**

3. Move the jumper(s), onto pins 1–2 (if not already there).  
If later you wish to return the jumper(s) to the default factory position, repeat step 2, returning the jumper to pins 2–3.



## Troubleshooting

---

This chapter contains information on troubleshooting problems and known issues.

- ◆ [Operating system/driver capabilities and limitations](#) ..... 134
- ◆ [Extended error logging by QLogic drivers](#) ..... 136
- ◆ [Understanding persistent binding](#) ..... 137
- ◆ [Known issues](#) ..... 140
- ◆ [Problems and solutions](#) ..... 141
- ◆ [Event codes from the QLogic STORPort driver](#) ..... 144

## Operating system/driver capabilities and limitations

The following capabilities and limitations should be noted for Windows operating systems with QLogic HBAs.

### LUNs

Theoretically, Windows supports up to 261,120 total LUNs. This figure is based on the listed support limitations for Windows Server from Microsoft: 8 buses per adapter, 128 targets per bus, and 255 LUNs per target. However, due to registry hive limitations, a Windows server is most likely to run out of registry space to keep track of these large LUN counts well before reaching this limit. Windows 2000 has this registry size issue. See Microsoft knowledge-base articles 292726 and 269075 for information. Windows 2003 does not have this issue.

Microsoft Windows limits the number of LUNs per HBA to 255 (LUNs 00-FE) even though the HBAs are capable of presenting 256 (LUNs 00-FF). It is a function of the operating system that prevents that last LUN from being presented to the user, and not the HBA or driver. This limitation should be taken into consideration when planning your host configuration.

Based on E-Lab testing, it has been determined that for EMC configurations, Windows servers should be limited to a maximum of 500 LUNs. In most cases, this number will be more than sufficient. In others, it may be deemed too small. For configurations where a large amount of storage is necessary, but not necessarily a large number of disks, EMC storage can be configured to present LUNs of large sizes to the host

### Volume sizes

Windows 2000 supports a maximum file system size of 2 TB (terabytes.)

Windows 2003 and Windows 2008 support a maximum file system size of 2 TB unless Service Pack 1 or later is installed. With SP1 or later, the maximum supported physical disk size is 256 TB.

---

**Note:** Volumes larger than 2 TB must use GPT partitions to support them. Refer to your Windows users guide for information on GPT partitions.

---

**Note:** Windows for x64 servers does not require SP1 or later to create GPT partitions.

---

EMC storage arrays provide the ability to expand the size of a LUN presented to the host server. Refer to your EMC array's documentation for procedures on expanding LUN sizes. Windows has the ability to recognize the extra space on these expanded LUNs by performing a rescan via the Disk Administrator window.

## Extended error logging by QLogic drivers

In driver versions prior to the 9.X family, additional messages were logged in the system event log when the "extended error logging" parameter was enabled in the HBA BIOS. The messages were primarily informational, but often confused users by appearing to be legitimate error messages.

Driver family 9.X and beyond will no longer log these additional messages in the event log even if the "extended error logging" parameter is enabled. New tools have been developed for developers and engineers troubleshooting customer problems without the need for these messages. Visit the website [http://www.qlogic.com/support/logs/event\\_log.asp](http://www.qlogic.com/support/logs/event_log.asp) for information about QLogic event messages.

## Understanding persistent binding

Persistent binding is the mechanism to create a continuous logical route from a storage device object in the Windows host to a volume in the EMC storage array across the fabric.

Without a persistent binding mechanism, the host cannot maintain persistent logical routing of the communication from a storage device object across the fabric to an EMC storage array volume. If the physical configuration of the switch is changed (for example, the cable is swapped or the host is rebooted), the logical route becomes inconsistent, causing possible data corruption if the user application is modifying data through inconsistent logical routing of the communication from the driver entry point to a volume in an EMC storage array across the fabric.

The Windows operating system (OS) does not provide a satisfactory means to allow persistent binding. Most software applications access storage using file systems managed by the Windows OS. (File systems are represented as <drive letters> <colons>, that is, C:, D:, and so forth.) For storage devices containing file systems, Windows writes a disk signature to the disk device. The operating system can then identify and associate with, a particular drive letter and file system.

Since the signature resides on the disk device, changes can occur on the storage end (a cable swap, for example) that can cause a disk device to be visible to the host server in a new location. However, the OS looks for the disk signature and, providing that nothing on the disk changed, associate the signature with the correct drive letter and file system. This mechanism is strictly an operating system feature and is not influenced by the Fibre Channel device driver.

Some software applications, however, do not use the Windows file systems or drive letters for their storage requirements. Instead they access storage drives directly, using their own built-in “file systems.” Devices accessed in this way are referred to as *raw devices* and are known as *physical drives* in Windows terminology.

The naming convention for physical drives is simple and is always the same for software applications using them. A raw device under Windows is accessed by the name \\.\PHYSICALDRIVE`XXX`, where `XXX` is the drive number. For example, a system with three hard disks attached using an QLogic Fibre Channel controller assigns the disks the names \\.\PHYSICALDRIVE0,

\.\.\PHYSICALDRIVE1, and \.\.\PHYSICALDRIVE2. The number is assigned during the disk discovery part of the Windows boot process.

During boot-up, the Windows OS loads the driver for the storage HBAs. Once loaded, the OS performs a **SCSI Inquiry** command to obtain information about all the attached storage devices. Each disk drive it discovers is assigned a number in a *semi-biased* first come, first serve fashion based on HBA. (*Semi-biased* means that the Windows system always begins with the controller in the lowest-numbered PCI slot where a storage controller resides. Once the driver for the storage controller is loaded, the OS selects the adapter in the lowest-numbered PCI slot to begin the drive discovery process.)

It is this naming convention and the process by which drives are discovered that makes persistent binding (by definition) impossible for Windows. Persistent binding requires a continuous logical route from a storage device object in the Windows host to a volume in an EMC storage array across the fabric. As mentioned above, each disk drive is assigned a number in a first-come, first-serve basis. This is where faults can occur.

*Example*

Imagine this scenario: A host system contains controllers in slots 0, 1, and 2. Someone removes a cable from the QLogic controller in host PCI slot 0, then reboots the host.

During reboot, the Windows OS loads the QLogic driver during reboot and begins disk discovery. Under the scenario presented above, there are no devices discovered on controller 0, so the OS moves to the controller in slot 1 and begins naming the disks it finds, starting with \.\.\PHYSICALDRIVE0. Any software applications accessing \.\.\PHYSICALDRIVE0 before the reboot will be unable to locate their data on the device, because it changed.

The following figure shows the original configuration before the reboot. HBA0 is in PCI slot 0 of the Windows host. Each HBA has four disk devices connected to it, so Windows has assigned the name \.\.\PHYSICALDRIVE0 to the first disk on HBA0. Each disk after that is assigned a number in sequence as shown in [Figure 78 on page 139](#).

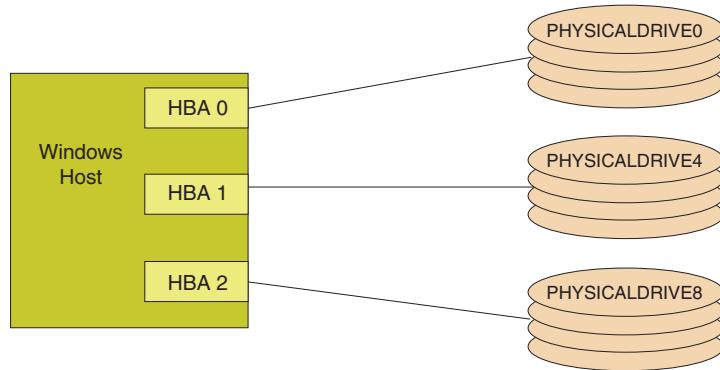


Figure 78 Original configuration before the reboot

Figure 79 shows the same host after the cable attached to HBA0 has been removed and the host rebooted. Since Windows was unable to do a discovery on HBA0, it assigned \\.\PHYSICALDRIVE0 to the first device it discovered. In this case, that first device is connected to HBA1. Due to the shift, any software application accessing \\.\PHYSICALDRIVE0 will not find data previously written on the original \\.\PHYSICALDRIVE0.

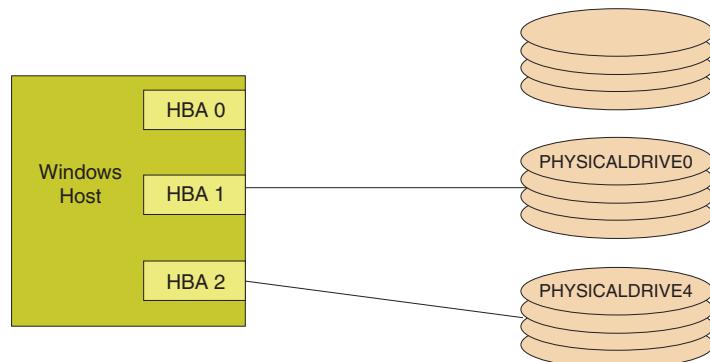


Figure 79 Host after the rebooted

The default driver behavior does not store target bindings between host reboots. The bindings are dynamically generated by the HBA when new target devices are detected.

**Note:** Tape devices are treated the same as disk devices in Windows with respect to persistent binding. Refer to your tape device documentation for more information.

## Known issues

Be aware of these issues:

- ◆ QLogic BIOS 1.26 and later for QLA23xx and BIOS 1.79 and later for QLA22xx HBAs allow for multiple **Boot Port Name** entries to be configured for high-availability booting after path failures. Previous BIOS versions do not support this functionality, will boot only from a single storage array port, and cannot provide boot capability with path failures.
- ◆ NTOSKLN BSOD (blue screen) during a link-down event can cause file system corruption to mounted file systems.
- ◆ HBA boot BIOS does not support high availability while the OS is booting. It can handle path failures at boot initialization time, and after the OS has loaded. Path failures while the OS is loading will require the host to reboot before successfully completing the boot process.
- ◆ Degraded response time as the I/O load approaches storage system capacity can make the OS appear hung or result in a NTOSKLN BSOD.
- ◆ Boot files, Windows system files, and swap space should all be on the boot LUN. With certain server models, you can use an internal disk for the page file for stability; however, this might not increase fault tolerance and might reduce system recovery options.
- ◆ Swap space must be available on %SYSTEMROOT% or core dump will fail.
- ◆ For Windows 2003 on 64-bit IA64-2 servers, the system no longer uses an x86-compatible BIOS; therefore, enabling boot-from-array support with the HBA requires a separate firmware EFI download.
- ◆ For servers booting from the array, a Symmetrix out-of-family microcode load, or a CLARiiON FLARE® NDU between versions will cause the server to require a reboot. This occurs because Windows requires a reboot when characteristics of the boot LUN change. During the NDU process on EMC storage arrays, the serial number and inquiry VPD data will change to reflect the new code version. When Windows performs a rescan and recognizes this change, it assumes a change has occurred on the boot LUN and will require a reboot.

## Problems and solutions

This section contains known problems and solutions.

### Problem 1

Error Message ID: 51 — In the event viewer when attempting to install multiple host access (for clustering) to the same EMC CLARiiON array storage group. The text of the message reads:

An Error was detected on device \Device\Harddisk<x>\DR<xx> during a paging operation

#### Solution

Until host cluster software is installed, only a single host should access a storage group at a time. Refer to the [EMC Support Matrix](#) for supported host configurations.

### Problem 2

EMC Knowledge base solution emc29097 — If using HBAs connected to both CLARiiON SPs, without PowerPath installed, duplicate LUNs will be visible in the Device Manager and Disk Manager. Only one instance of the LUN will be accessible, and all other matching mappings will be listed as Unknown, Unreadable, and Unallocated.

#### Solution

This is normal behavior when multiple paths are available, PowerPath is not installed, and the initiator type is registered in PowerPath mode (array default depending on core code revision).

### Problem 3

EMC Knowledgebase solution emc69307 — When using QLogic HBAs in a Brocade fabric environment, after upgrading Brocade 3900-series switch firmware to 3.0.2m, the HBAs report repeated link errors, and intermittently lose fabric connectivity.

PowerPath may report paths lost and then found in quick succession, and repeated Windows 2000 event log error entries for Link Down/Link Up events similar to the following:

Event ID: 11  
 Source: ql2300  
 Description: The driver detected a controller error on \Device\Scsi\ql2300x.  
 Data (words): offset 34 = 80120000 [ErrorCode: **Link down error**]

Event ID: 11  
 Source: ql2300  
 Description: The driver detected a controller error on \Device\Scsi\ql2300x.  
 Data (words): offset 34 = 80110000 [ErrorCode: **Link up**]

**Solution** Upgrade to the latest HBA driver. This was corrected for Windows 2000 in 8.2.2.25 and later drivers. Windows 2003 driver 8.2.2.20 and later already contain this correction.

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#### Problem 4

EMC Knowledge base solution emc69308 — Direct-connect to EMC CLARiON CX200 reports incorrect queue full error messages. Even under light I/O, a host may log a message noting that disk has reached a queue-full state similar to the following in the Windows event viewer:

Event ID: 11  
Source: ql2300

Description: The driver detected a controller error on \Device\Scsi\ql2300x.  
Data (words): offset 34 = F003001C [ErrorCode: Target device queue full].

**Solution** Upgrade to the latest HBA driver. This was corrected in version 8.2.2.25 and later drivers.

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#### Problem 5

Windows 2000 hosts running less than SP4 could be susceptible to data loss during LUN expansion operations.

**Solution** This issue is corrected by Microsoft in SP4, or by applying hot fix 327020. Refer to EMC Knowledge base solution emc73538 and Microsoft Knowledge Base article 327020 for more information.

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#### Problem 6

For Windows 2003, the STORPort drivers 8.2.3.26 with Microsoft hotfix Q823728 and earlier do not yet fully support all Microsoft VSS functions.

**Solution** This was first corrected in Microsoft QFE hot fix Q837413 and to be used with minimum 8.2.3.27 driver. You should also use minimum Microsoft VSS QFE 833167.

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**Problem 7**

When using SANsurfer 2.0.25 to update to BIOS 1.4x, you receive the message as follows:

Incorrect BIOS file selected.  
The selected BIOS file does not match the selected HBA type.  
Check your file and try again.

**Solution** SANsurfer 2.0.25 does not support flashing the 1.4x BIOS, you need to use the DOS FLASUTIL utility. This will be corrected in a future SANsurfer release.

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**Problem 8**

IBM eServer BladeCenter HS20 Fibre Channel Expansion Card 48P7061 may not update all HBA BIOS in the system when using FLASUTIL.

**Solution** You may need to run FLASUTIL multiple times, and use /F to specify specific HBAs to update. Refer to the FLASUTIL instructions for further information.

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**Problem 9**

Certain builds of SANsurfer running on Windows 2008 will cause event ID 7030 to appear in the system even log.

**Solution** Windows 2008 no longer supports interactive services. The QLogic QLManagement Agent for SANsurfer is an interactive service. This event message, while annoying, is harmless to the functionality of the software and operating system. EMC and QLogic do not recommend removing the service as it may affect the HBA driver.

## Event codes from the QLogic STORPort driver

QLogic STORPort drivers often place driver event codes in the Windows event viewer. These codes may be driver or hardware errors that have been detected, or in many instances are simply warning or informational messages for the user.

Most events that the QLogic drivers log are event 11 codes. To decipher what these event 11 codes mean, please visit the QLogic support site for their *Guide to Interpreting Windows Event Viewer Entries* at

[http://support.qlogic.com/support/logs/event\\_log.asp](http://support.qlogic.com/support/logs/event_log.asp)

## Third-Party Software

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This appendix contains additional information about third-party software used with Windows hosts.

- ◆ [QLogic SANsurfer SANblade Manager](#) ..... 146

## QLogic SANsurfer SANblade Manager

**Note:** Stratus ftServers are not supported using the QLogic SANsurfer SANblade Manager Software or Agents.

EMC has approved the use of a specialized version of the QLogic SANsurfer SANblade Manager for use with attached EMC Symmetrix and CLARiiON storage arrays. Only the versions listed below should be used; these versions are posted in the EMC section on the QLogic website.

This Windows utility provides information on the installed QLogic HBAs, driver versions, mapped targets, statistics, and configuration settings. It also has a feature to update the HBA firmware/BIOS and NVRAM. (You should obtain the latest EMC-approved firmware/BIOS and NVRAM files from the QLogic website. Refer to ["Downloading latest QLogic drivers/firmware/BIOS files" on page 16](#) for instructions.)

For information on the use and features of the QLogic SANsurfer SANblade Manager utility, refer to the documentation posted with this utility.

### SANsurfer version history

SANsurfer versions include:

- ◆ 2.0.21 — Initial Release

**Note:** The SANsurfer software is not multipath-aware, and as such may misreport HBA targets that are configured in multipath. This does not affect the use of the tool; however, it will accurately report targets only on ports that own an active LUN0.

- ◆ 2.0.25 — Added target persistent binding capability and display correction for LUNs on non-owning SP. (This functionality is supported by QLogic; all usage questions and support issues should be directed to QLogic.)

**Note:** SANsurfer 2.0.25 cannot be used to upgrade to BIOS 1.4x. Until a later SANsurfer is available, you will need to use the procedure ["Install/upgrade firmware and boot BIOS from DOS" on page 25](#) to perform this upgrade.

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**Note:** This version of SANsurfer may display HBA options under different menu names than appear in the HBA Ctrl-Q menu, as well as in previous SANsurfer versions. All user-configurable options are still accessible.

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- ◆ 2.0.30 Build 52 — Added display correction for LUNs greater than 2 Tb in size.
- ◆ 2.0.30 Build 78 — Added support for new Qlogic HBAs and SNIA libraries.

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**Note:** This version of SANsurfer should be used with drivers 9.1.2.16 (STORPort) and 9.1.2.11 (SCSIPort).

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- ◆ 2.0.30 Build 78 — Contained updated features/functionality. Added support for new HBAs/SNIA libraries.
- ◆ 5.0.0 Build 17 — Added updated features/functionality. Included support for newly supported HBAs/SNIA libraries.
- ◆ 5.0.1 build 31 — Added updated features/functionality for new HBA models and drivers. Added functionality to allow firmware/BIOS flash of OEM HBA models.

